

ISED CABid: ES1909

Test report No:
NIE: 70573RRF.004A1

Test Report

USA FCC Part 15.247, 15.209

CANADA RSS-247, RSS-Gen

(*) Identification of item tested	CP1110 Sound Processor
(*) Trademark	Cochlear
(*) Model and /or type reference	CP1110
Other identification of the product	HW version: Build W SW version: 1122C00!00 (#992907) FCC ID: WTO-CP1110 IC: 8039A-CP1110
(*) Features	BTLE 5.0, Proprietary protocol 2.4 GHz, 5MHz Transcutaneous Link
Applicant	COCHLEAR LTD 1 University Avenue, Macquarie University, NSW 2109 Australia
Test method requested, standard	USA FCC Part 15.247 (10-1-20 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-20 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 amendment 1 (March 2019). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager  2022.11.30 15:46:16 +01'00'
Date of issue	2022-11-30
Report template No	FDT08_24 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory, CABid: ES1909, with the appropriate scope of accreditation that covers the performed tests in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a CP1110 Sound Processor. CP1110 Sound Processor is part of a cochlear implant system. It is worn behind-the-ear and its purpose is to capture and digitally process sound, as well as to transfer the audio data and power to the cochlear implant over a transcutaneous link.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of result.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
70573B/006	Sound Processor	CP1110	1010161021462W	2022/01/13
70573B/017	Power Extend Battery	M96X	G25007A	2022/01/13

Sample S/01 has undergone the following test(s): All Conducted tests indicated in Appendix A.

- Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
70573B/008	Sound Processor	CP1110	1010161022858W	2022/01/13
70573B/011	Combined Link Coil, 11cm	CP1110	1182094W	2022/01/13
70573B/015	Implant device	CI512	1020121913217	2022/01/13
70573B/016	Power Extend Battery	M96X	G25007A	2022/01/13

Sample S/02 has undergone the following test(s): All Radiated tests indicated in Appendix A.

Test sample description

Ports..... :	Port name and description	Cable				
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾	
	--		☐	☐	☐	
Supplementary information to the ports..... :	--					
Rated power supply	Voltage and Frequency		Reference poles			
			L1	L2	L3	N
	☒	DC: 3.7 Vdc				
Rated Power	--					
Clock frequencies	--					
Other parameters..... :	--					
Software version	1122C00!00 (#992907)					
Hardware version..... :	Build W					
Dimensions in cm (W x H x D)..... :	--					
	☒	Other: Body-worn - behind the ear				
Modules/parts	Module/parts of test item	Type			Manufacturer	
	--	--			--	
Accessories (not part of the test item)	Description	Type			Manufacturer	
	--	--			--	
Documents as provided by the applicant..... :	Description	File name			Issue date	
	--	--			--	

⁽³⁾ Only for Medical equipments.

Identification of the client

COCHLEAR LTD
1 University Avenue, Macquarie University, NSW 2109 Australia

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-02-03
Date (finish)	2021-03-05

Document history

Report number	Date	Description
70573RRF.004	2022-04-21	First release.
70573RRF.004A1	2022-11-30	First modification: typo of settings. This modification test report cancels and replaces the test report 70573RRF.004s

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Miguel Manuel López, Javier Miguel Nadales and Alfonso Gutiérrez.

Used instrumentation:

Conducted Measurements:

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
2.	Signal Generator 8 KHz-6 GHz, ROHDE AND SCHWARZ SMB100B	2019/10	2021/10
3.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV 40	2021/02	2023/02
4.	OPEN SWITCH UNIT OSP120 ROHDE AND SCHWARZ	2022/03	2024/03
5.	OPEN SWITCH UNIT UP TO 7.5 GHz OSP150 ROHDE AND SCHWARZ	2021/08	2023/08
6.	Software WMS 32 ROHDE & SCHWARZ	N/A	N/A

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
3.	Hybrid Bilog Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2020/10	2023/10
4.	Pre-amplifier G>40dB 10MHz-6GHz Bonn Elektronik BLNA 0160-01N	2022/03	2023/03
5.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2021/11	2023/11
6.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
7.	RF Pre-amplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2021/06	2022/06
8.	Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2020/07	2022/07
9.	Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
10.	Pre-amplifier, G>30 dB, 18-40 GHz BONN ELEKTRONIK BLMA 1840-4A	2021/09	2023/09
11.	Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
12.	Pre-amplifier, G>30 dB, 18-40 GHz BONN ELEKTRONIK BLMA 1840-4A	2021/09	2023/09
13.	Signal and Spectrum Analyzer 40 GHz Rohde and Schwarz FSV40	2021/10	2023/10

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

Bluetooth Low Energy 5.0 (2M, 1M).

FCC PART 15 PARAGRAPH/ RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.247 (a)(2) / RSS-247 5.2. (a)	6 dB Bandwidth	P	
FCC 15.247 (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P	
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	P	
FCC 15.247 (e) / RSS-247 5.2. (b)	Power spectral density	P	
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u>			
None.			

Appendix A: Test results. Bluetooth Low Energy 5.0 (2M, 1M)

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FCC 15.247 (d) / RSS-247 5.5. Emission Limitations Radiated (Transmitter)38

TEST CONDITIONS

(*) Declared by applicant.

POWER SUPPLY (*):

Vnominal: 3.7 Vdc
Type of Power Supply: Rechargeable battery.

ANTENNAS (*):

Type of Antenna: Integral.
Maximum Declared Antenna Gain: +2.40 dBi

TEST FREQUENCIES:

Low Channel: 2402 MHz
Middle Channel: 2440 MHz
High Channel: 2480 MHz

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1 m for the frequency range 17 GHz-26 GHz (antenna and 18 GHz-40 GHz horn antenna).

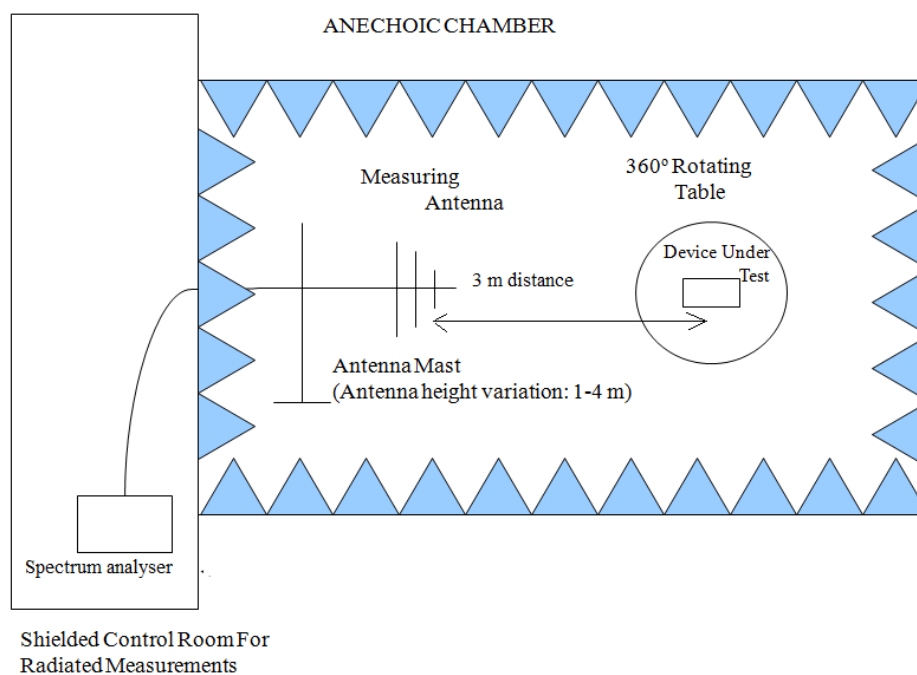
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

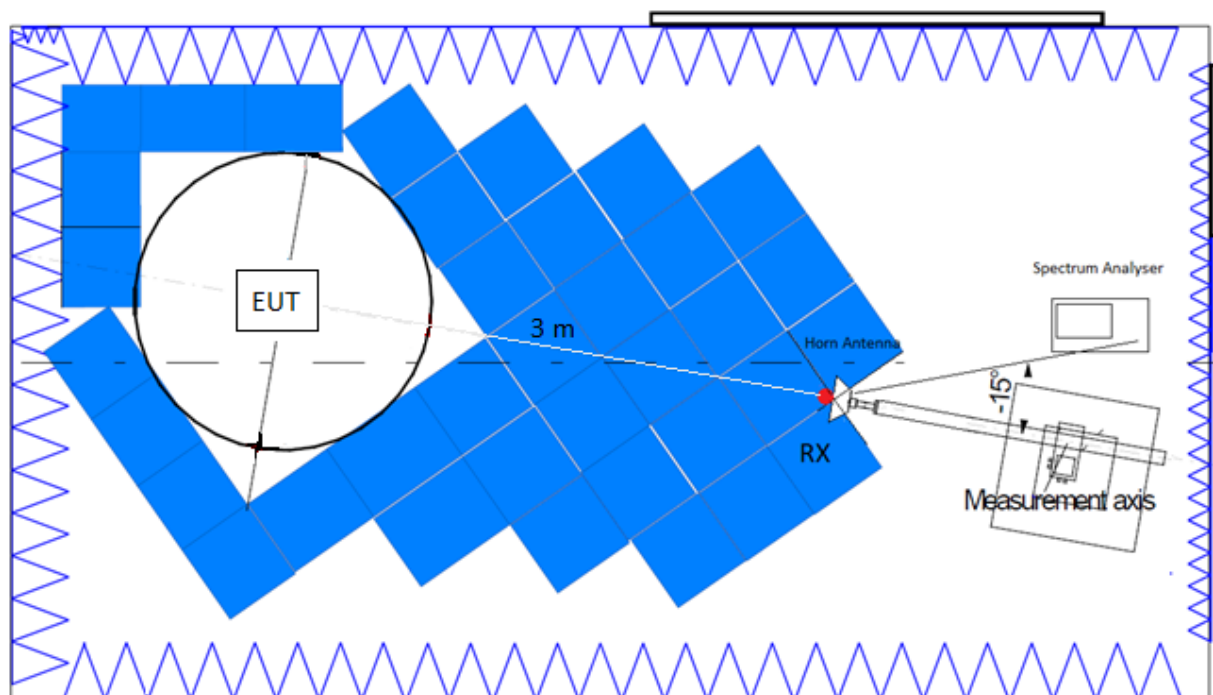
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

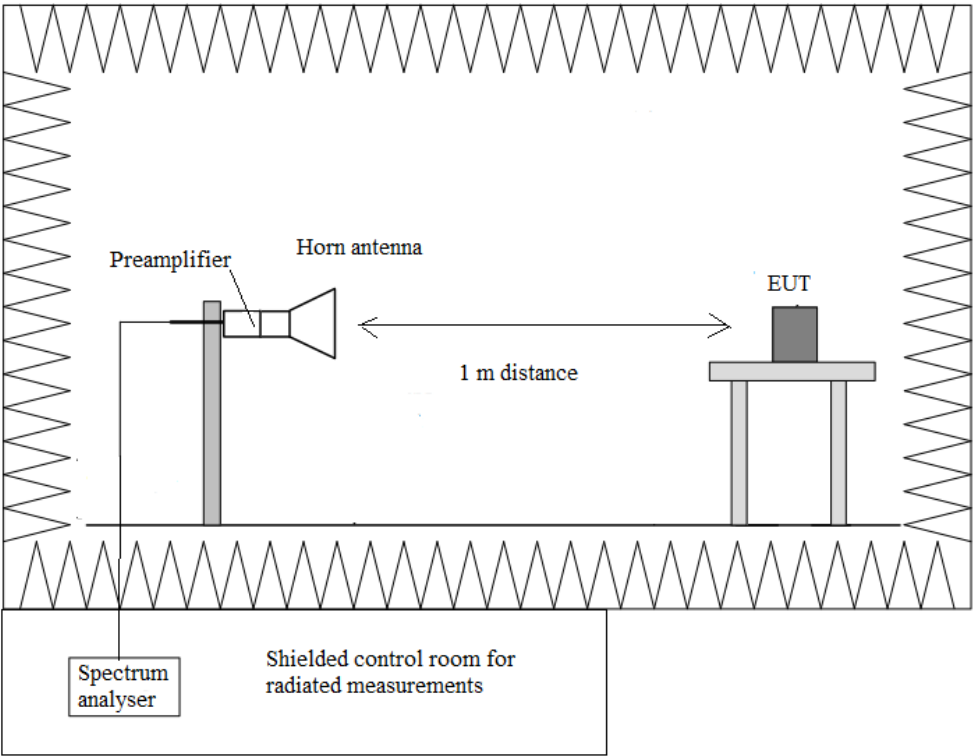
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17\text{ GHz}$:



Occupied Bandwidth

RESULTS:

- 2M modulation:**

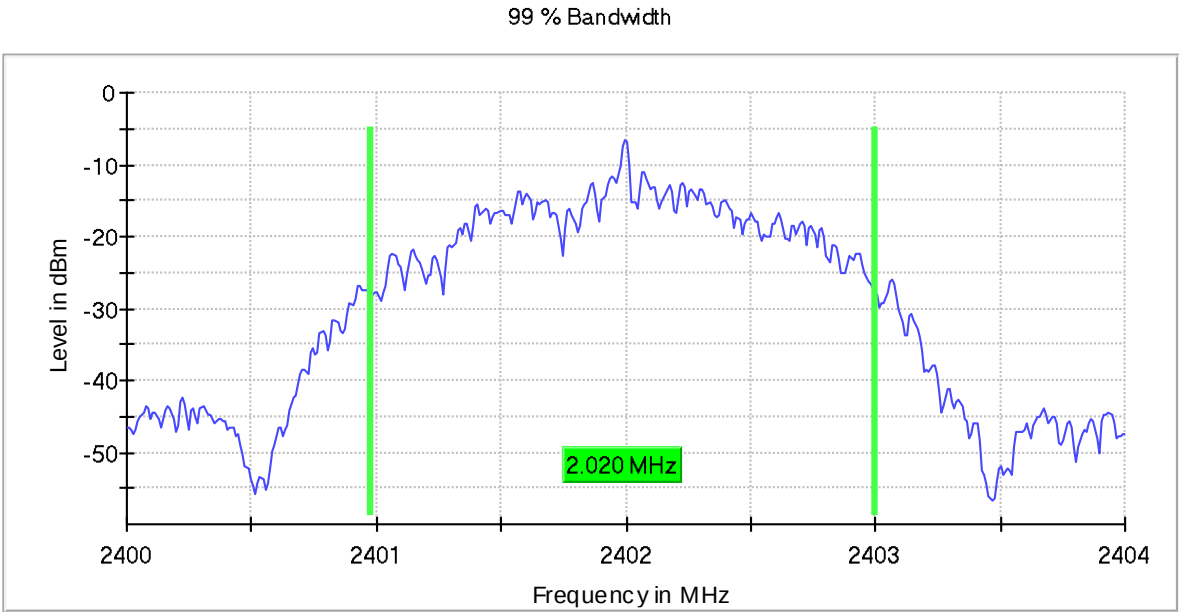
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% bandwidth (MHz)	2.02	2.00	2.03
Measurement uncertainty (%)	<± 1.17		

- 1M modulation:**

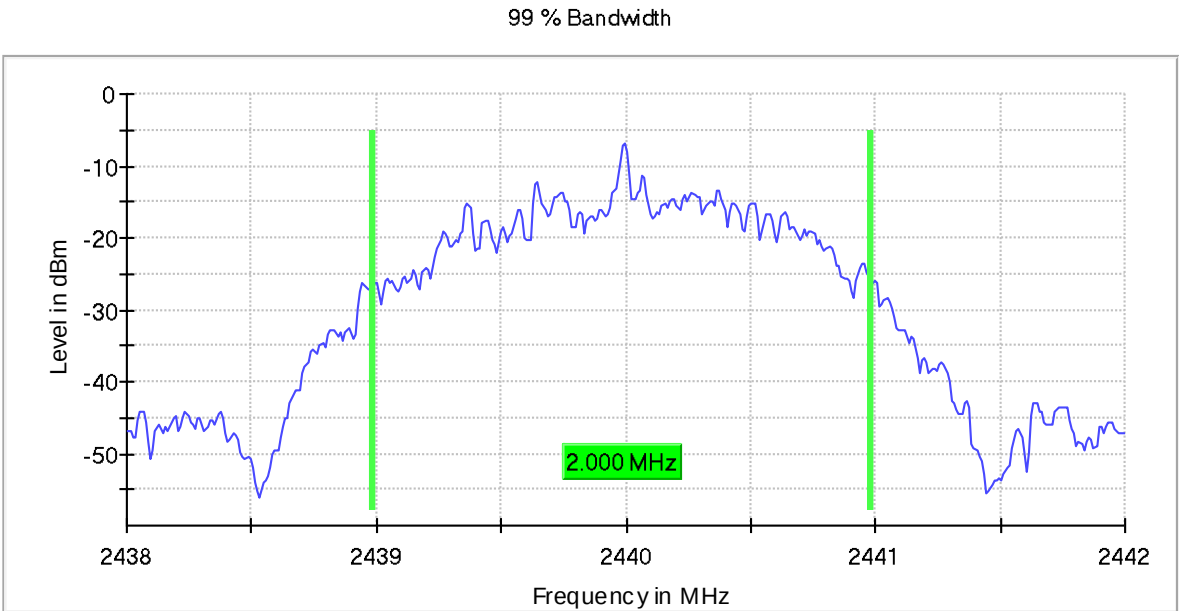
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% bandwidth (MHz)	1.05	1.02	1.06
Measurement uncertainty (kHz)	<± 1.17		

2M modulation:

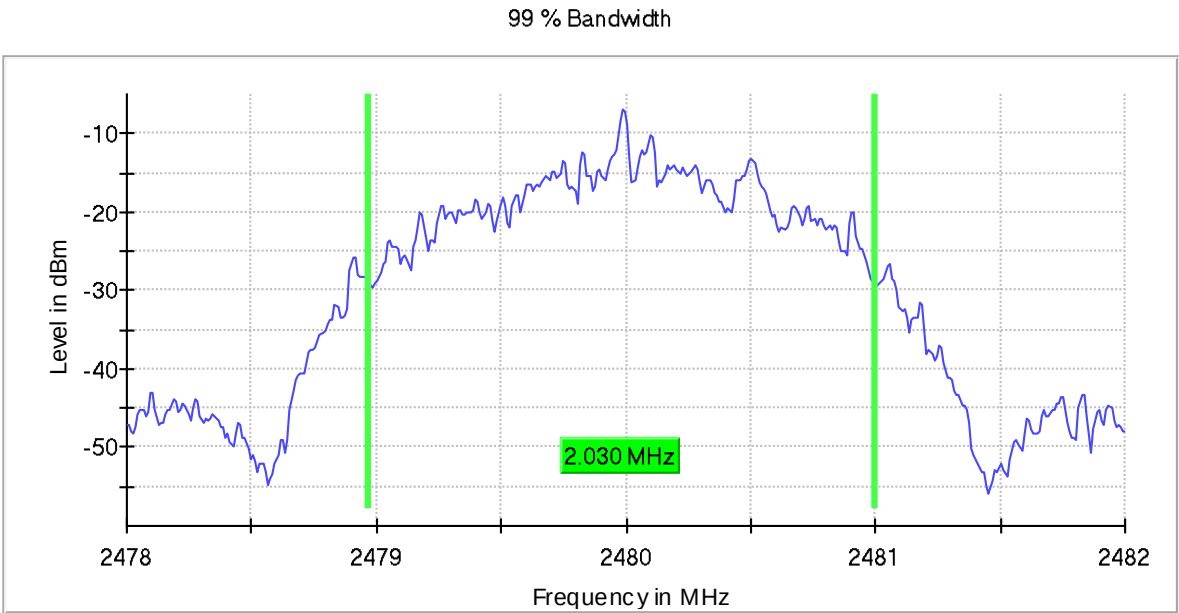
- Low Channel:



- Middle Channel:



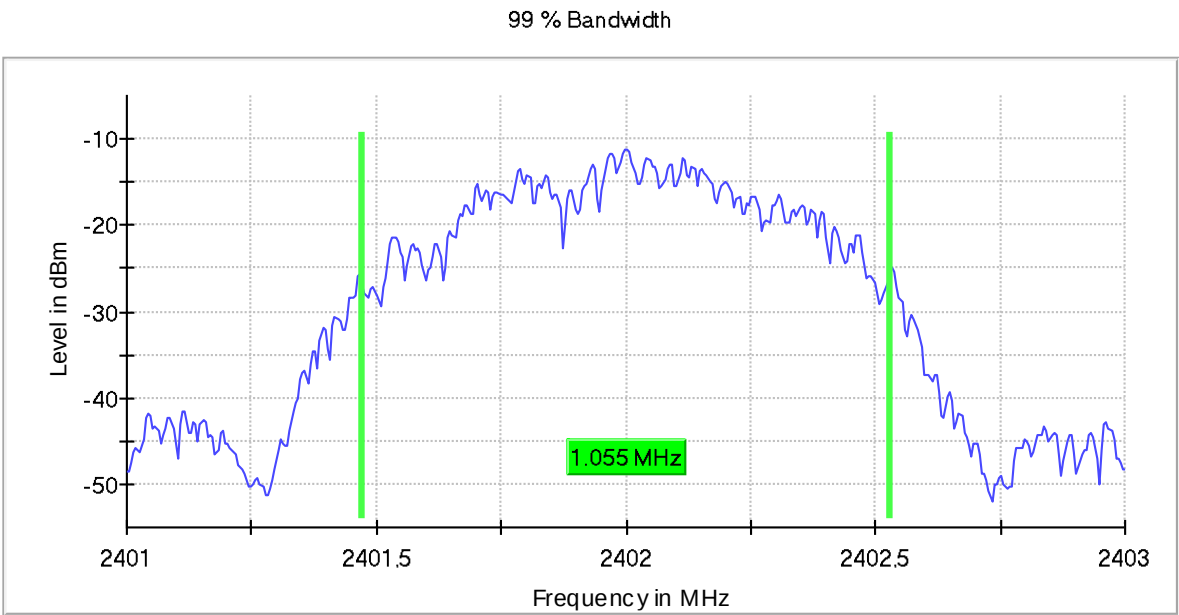
- High Channel:



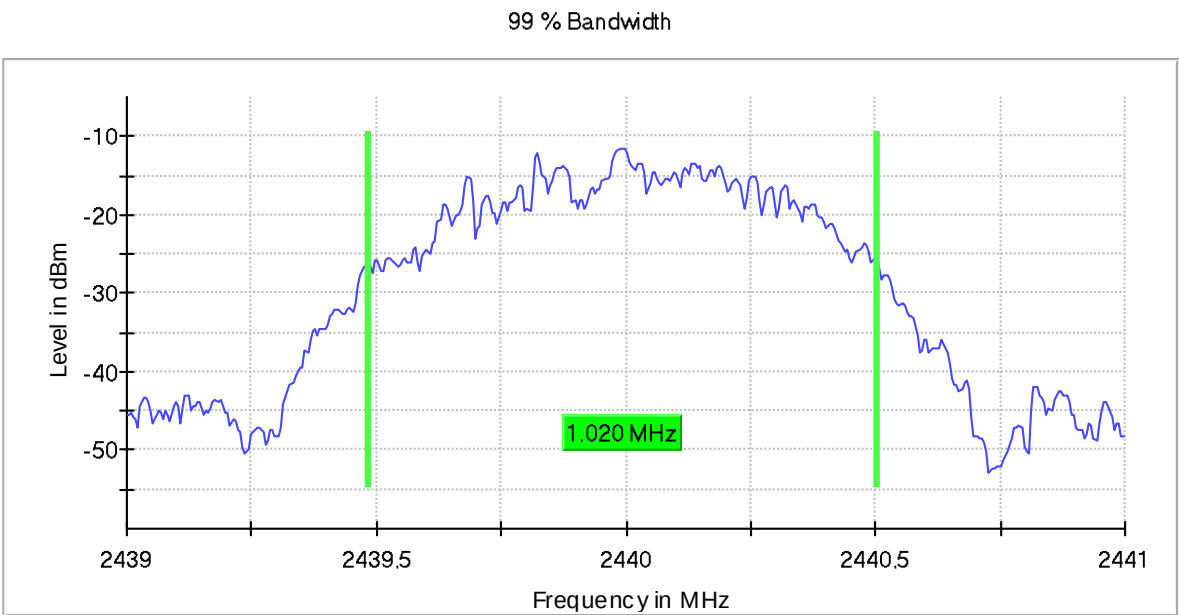
Setting	Instrument Value (Low Channel)	Instrument Value (Middle Channel)	Instrument Value (High Channel)
Start Frequency	2.40000 GHz	2.43800 GHz	2.47800 GHz
Stop Frequency	2.40400 GHz	2.44200 GHz	2.48200 GHz
Span	4.000 MHz	4.000 MHz	4.000 MHz
RBW	20.000 kHz	20.000 kHz	20.000 kHz
VBW	100.000 kHz	100.000 kHz	100.000 kHz
SweepPoints	400	400	400
SweepTime	94.824 µs	94.824 µs	94.824 µs
Reference Level	-10.000 dBm	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	10.000 dB	10.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
SweepCount	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Preamp	off	off	off
Stablemode	Trace	Trace	Trace
Run	13 / max. 150	13 / max. 150	13 / max. 150

• 1M modulation:

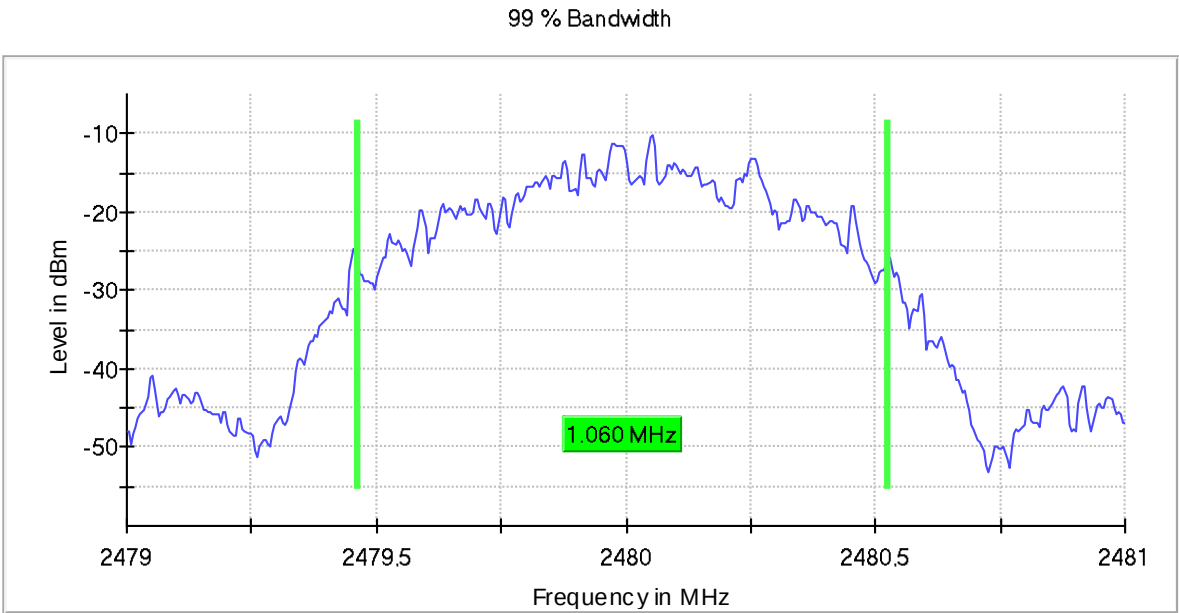
- Low Channel:



- Middle Channel:



- High Channel:



Setting	Instrument Value (Low Channel)	Instrument Value (Middle Channel)	Instrument Value (High Channel)
Start Frequency	2.40100 GHz	2.43900 GHz	2.47900 GHz
Stop Frequency	2.40300 GHz	2.44100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz	2.000 MHz
RBW	10.000 kHz	10.000 kHz	10.000 kHz
VBW	30.000 kHz	30.000 kHz	30.000 kHz
SweepPoints	400	400	400
Sweptime	189.648 µs	189.648 µs	189.648 µs
Reference Level	-10.000 dBm	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	10.000 dB	10.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
SweepCount	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Preamp	off	off	off
Stablemode	Trace	Trace	Trace
Run	38 / max. 150	13 / max. 150	13 / max. 150

FCC 15.247 (a)(2) / RSS-247 5.2. (a) 6 dB Bandwidth

SPECIFICATION:

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS:

- 2M modulation:**

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
6 dB Spectrum bandwidth (MHz)	0.91	0.95	1.03
Measurement uncertainty (%)	<±2.84		

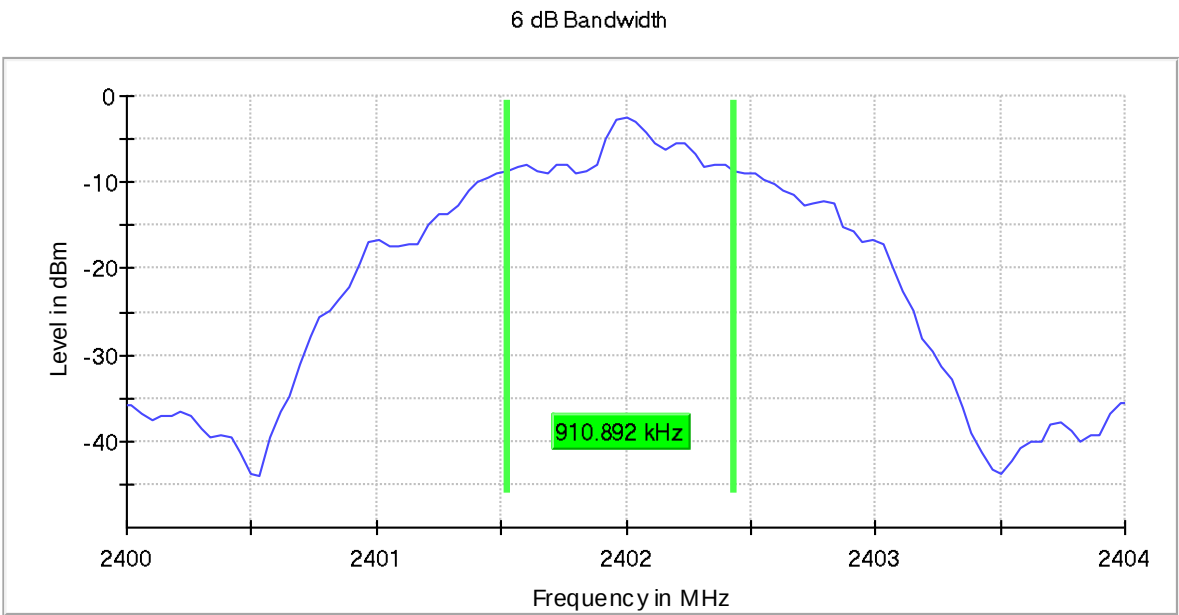
- 1M modulation:**

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
6 dB Spectrum bandwidth (MHz)	0.69	0.69	0.69
Measurement uncertainty (%)	<±2.84		

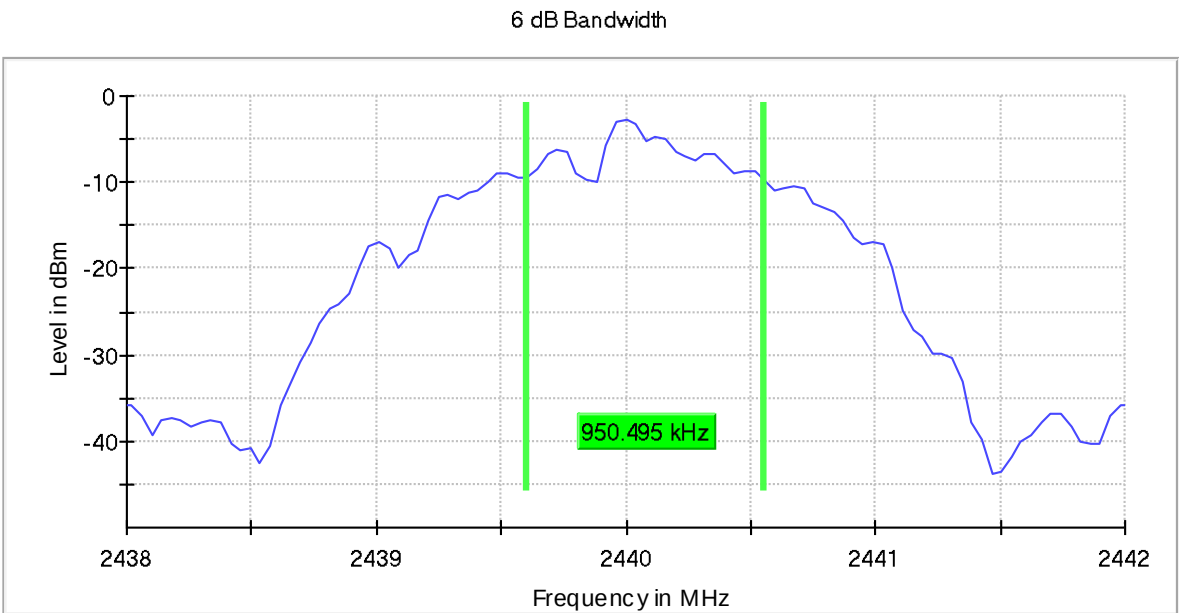
Verdict: PASS

2M modulation:

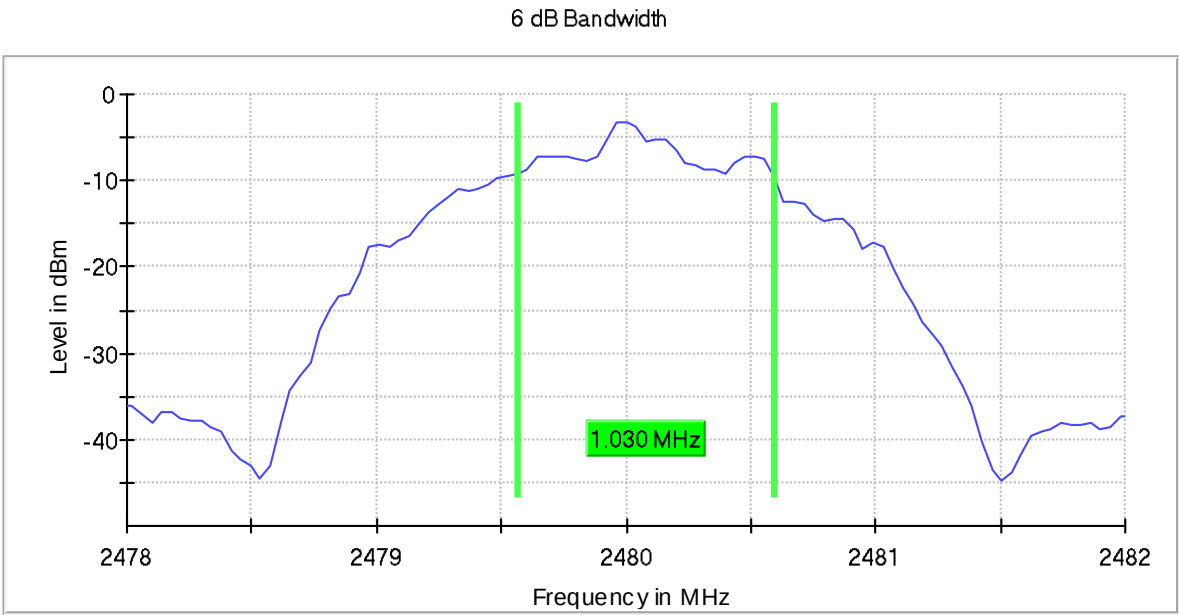
- Low Channel:



- Middle Channel:



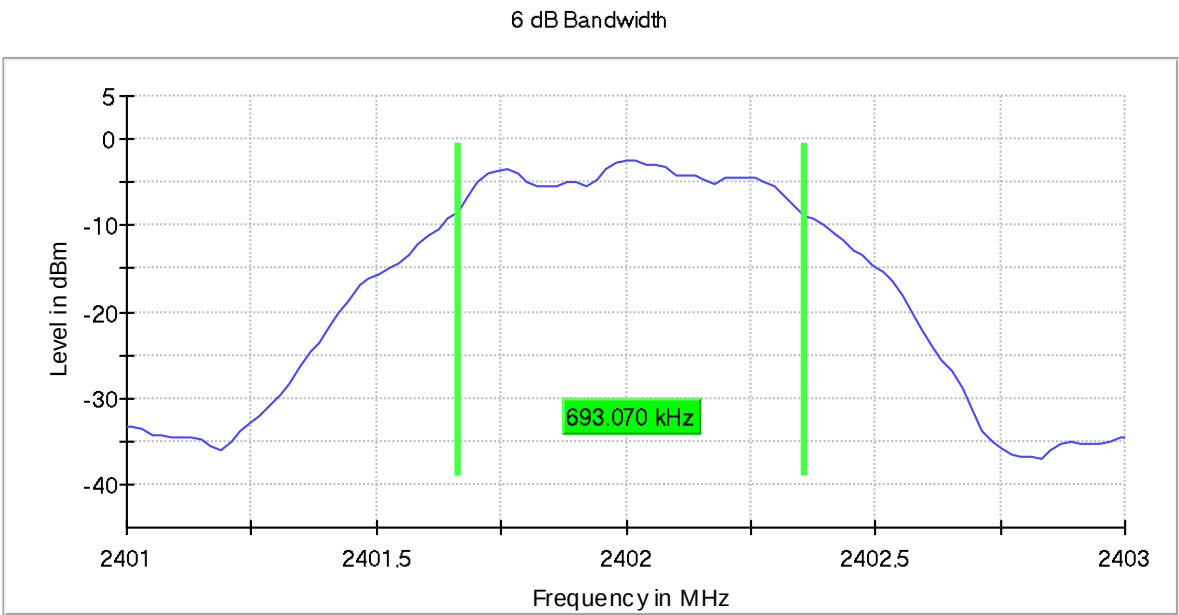
- High Channel:



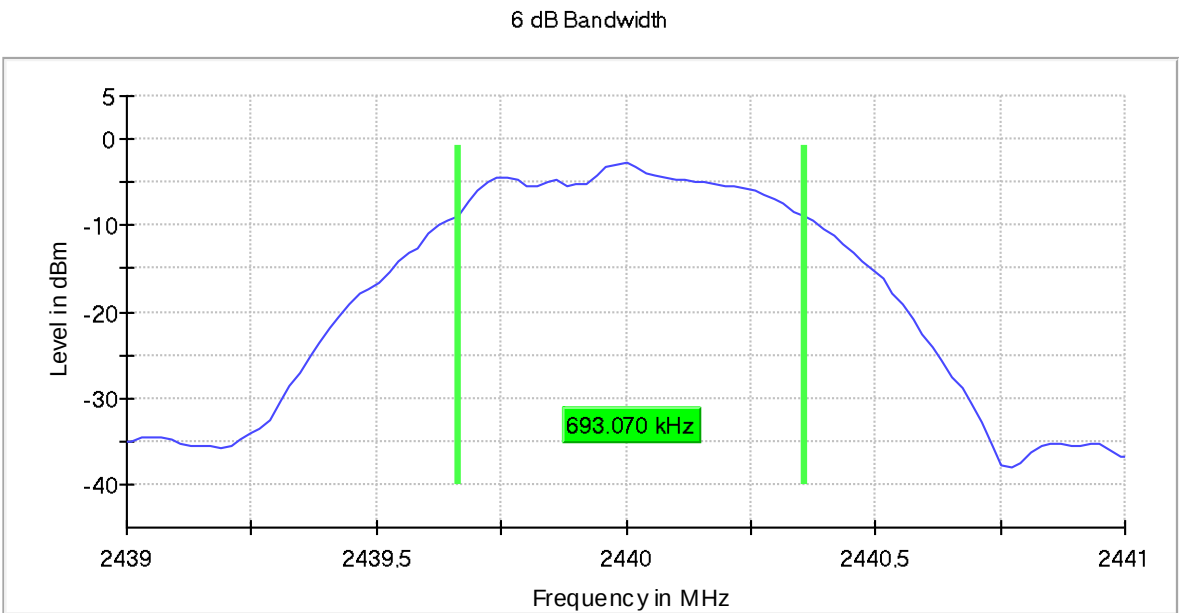
Setting	Instrument Value (Low Channel)	Instrument Value (Middle Channel)	Instrument Value (High Channel)
Start Frequency	2.40000 GHz	2.43800 GHz	2.47800 GHz
Stop Frequency	2.40400 GHz	2.44200 GHz	2.48200 GHz
Span	4.000 MHz	4.000 MHz	4.000 MHz
RBW	100.000 kHz	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz	300.000 kHz
SweepPoints	101	101	101
SweepTime	18.938 µs	18.938 µs	18.938 µs
Reference Level	-10.000 dBm	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	10.000 dB	10.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
SweepCount	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Preamplifier	off	off	off
Stablemode	Trace	Trace	Trace
Run	13 / max. 150	13 / max. 150	13 / max. 150

1M modulation:

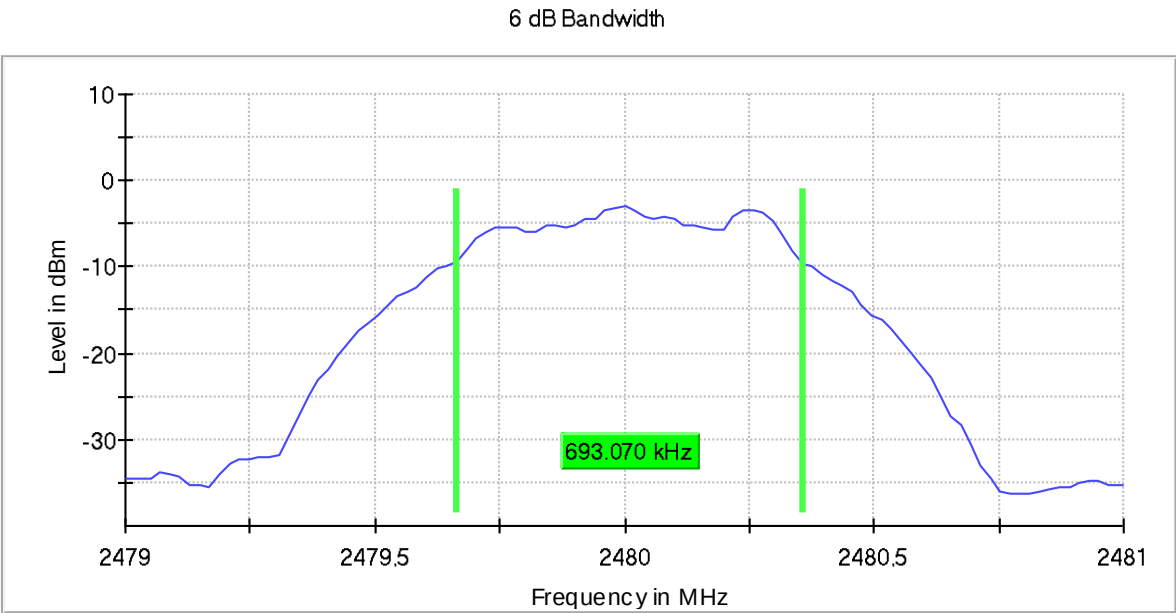
- Low Channel:



- Middle Channel:



- High Channel:



Setting	Instrument Value (Low Channel)	Instrument Value (Middle Channel)	Instrument Value (High Channel)
Start Frequency	2.40100 GHz	2.43900 GHz	2.47900 GHz
Stop Frequency	2.40300 GHz	2.44100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz	2.000 MHz
RBW	100.000 kHz	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz	300.000 kHz
SweepPoints	101	101	101
SweepTime	18.938 µs	18.938 µs	18.938 µs
Reference Level	-10.000 dBm	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	10.000 dB	10.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
SweepCount	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Preamplifier	off	off	off
Stablemode	Trace	Trace	Trace
Run	38 / max. 150	13 / max. 150	13 / max. 150

FCC 15.247 (b) / RSS-247 5.4. (d) Maximum Output Power and Antenna Gain

SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).
The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS:

The maximum peak conducted output power level in the fundamental emission was measured using the method according to point 11.9.1.1 "RBW $\geq$ DTS bandwidth" of ANSI C.63.10-2013.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Maximum Declared Antenna Gain: +2.40 dBi

• 2M modulation:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	-2.02	-1.74	-2.94
Maximum EIRP Power (dBm)	+0.38	+0.66	-0.54
Measurement uncertainty (dB)	< $\pm$ 0.80		

• 1M modulation:

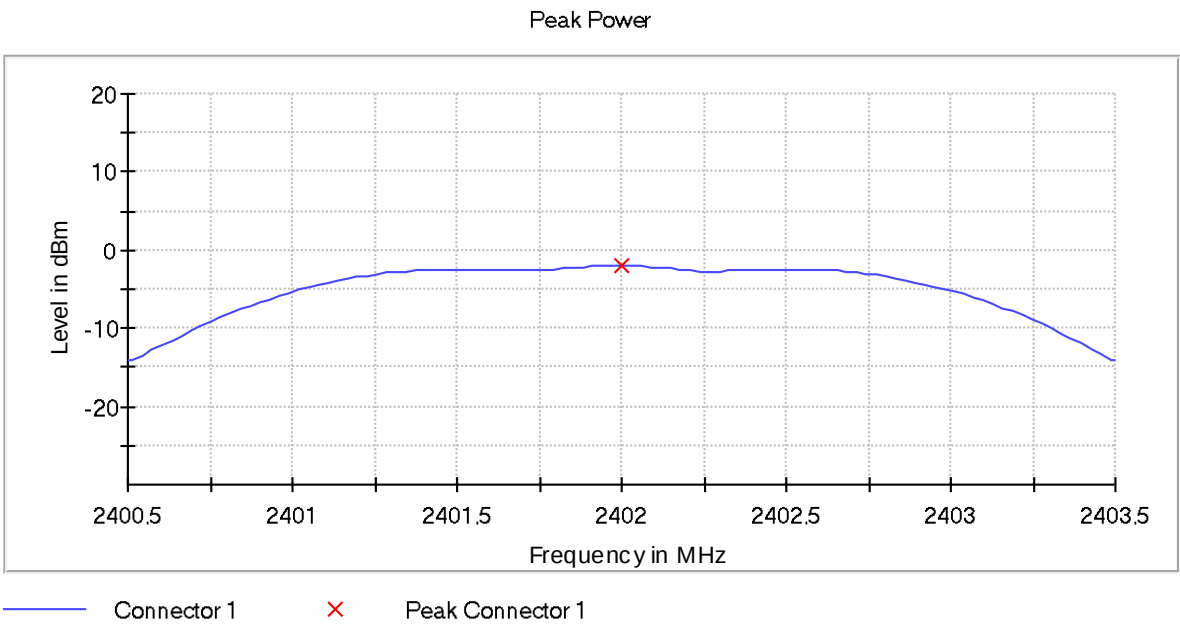
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	-2.33	-2.62	-2.57
Maximum EIRP Power (dBm)	+0.07	-0.22	-0.17
Measurement uncertainty (dB)	< $\pm$ 0.80		

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

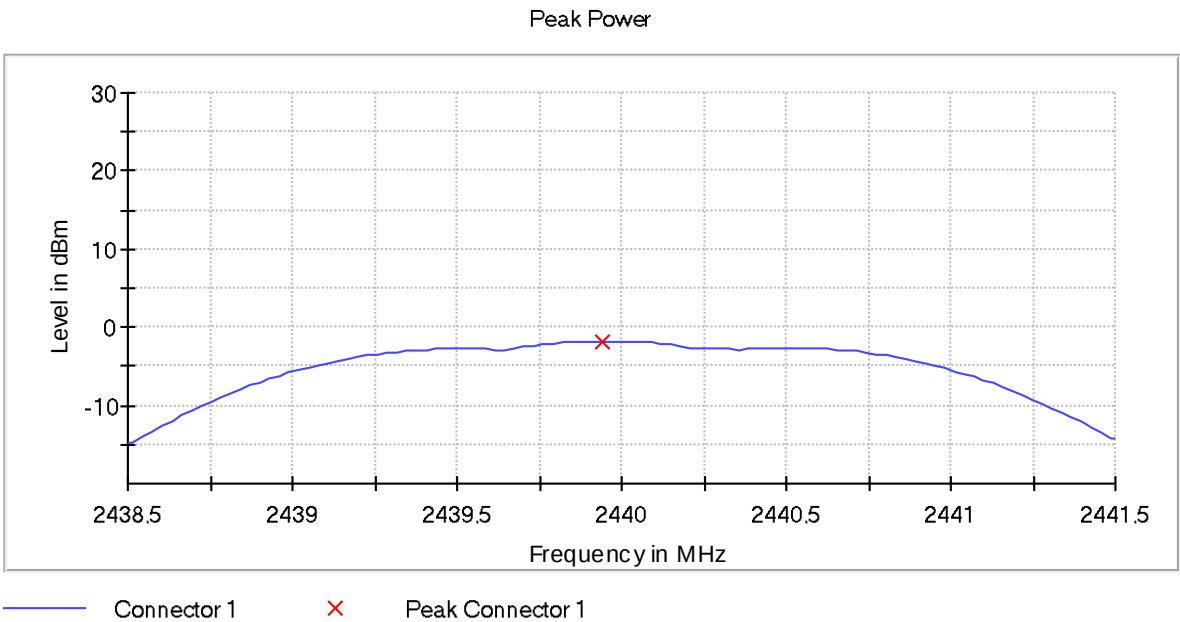
Verdict: PASS

2M modulation:

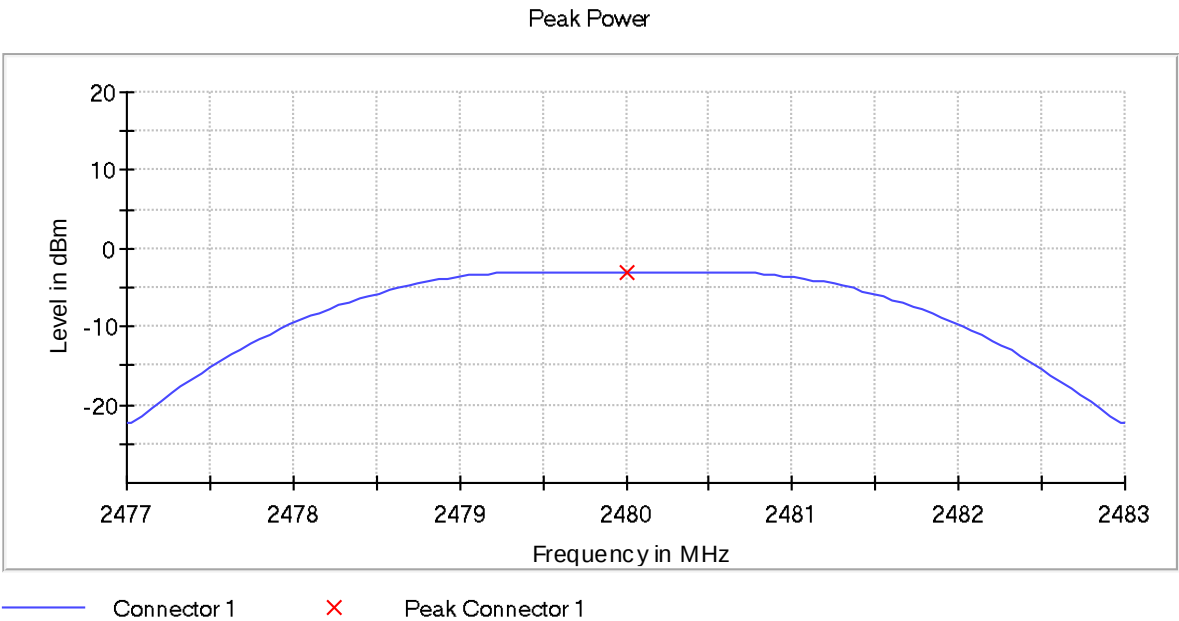
- Low Channel:



- Middle Channel:



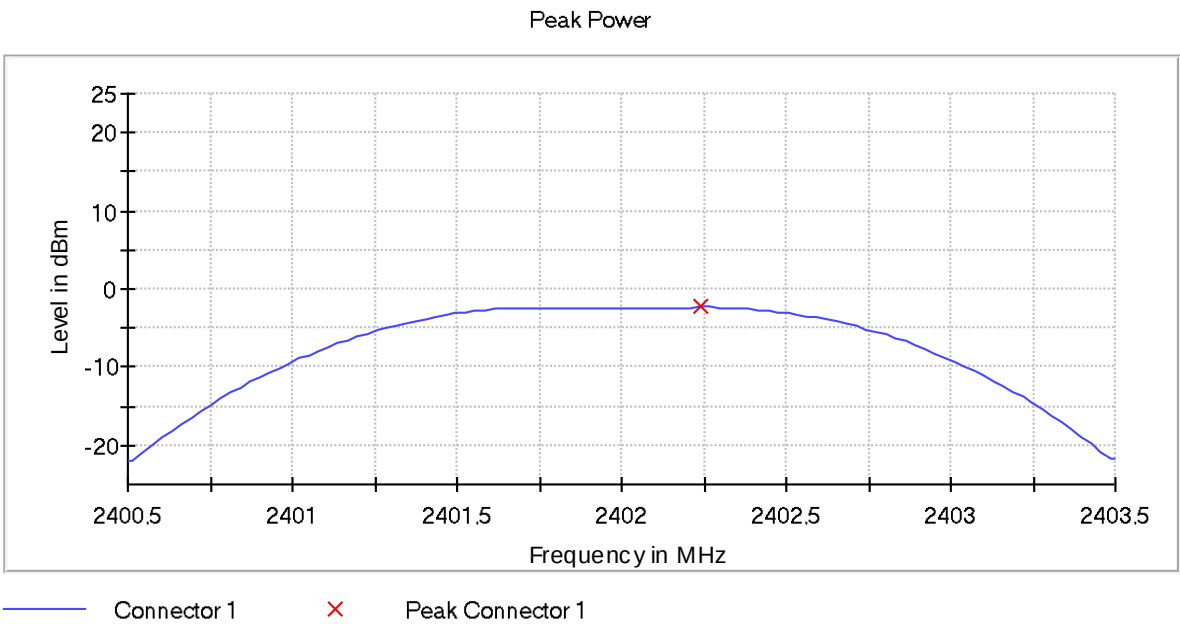
- High Channel:



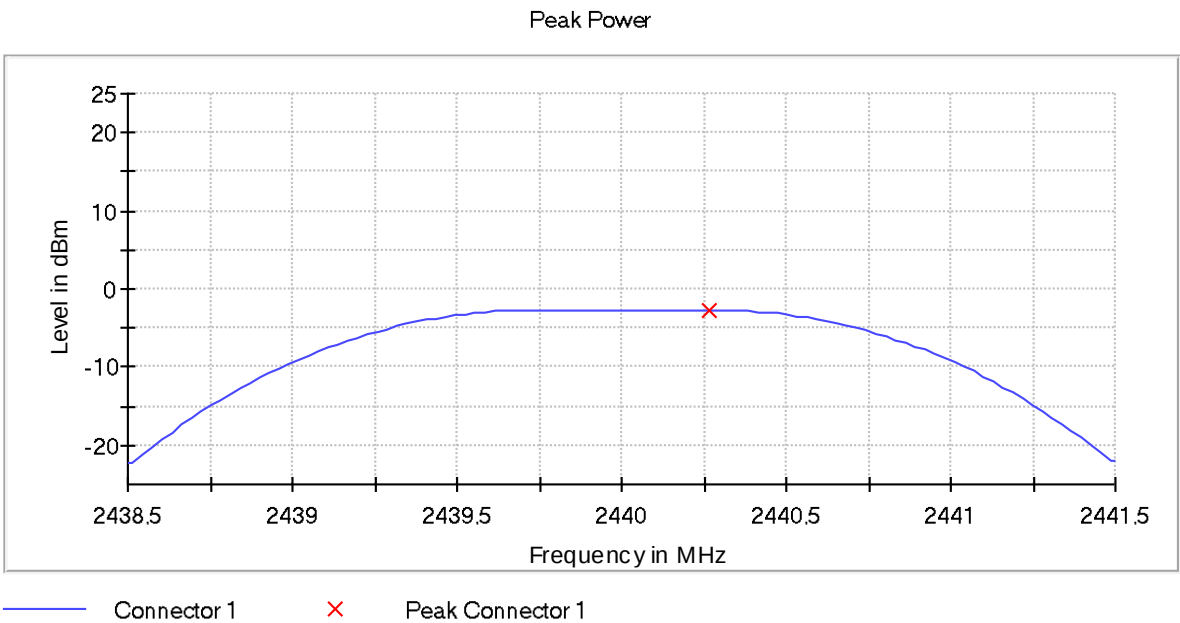
Setting	Instrument Value (Low Channel)	Instrument Value (Middle Channel)	Instrument Value (High Channel)
Start Frequency	2.40050 GHz	2.43850 GHz	2.47700 GHz
Stop Frequency	2.40350 GHz	2.44150 GHz	2.48300 GHz
Span	3.000 MHz	3.000 MHz	6.000 MHz
RBW	1.000 MHz	1.000 MHz	2.000 MHz
VBW	3.000 MHz	3.000 MHz	10.000 MHz
SweepPoints	101	101	101
SweepTime	1.907 µs	1.907 µs	953.450 ns
Reference Level	0.000 dBm	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	20.000 dB	20.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
SweepCount	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Preamp	off	off	off
Stablemode	Trace	Trace	Trace
Run	5 / max. 150	5 / max. 150	4 / max. 150

• 1M modulation:

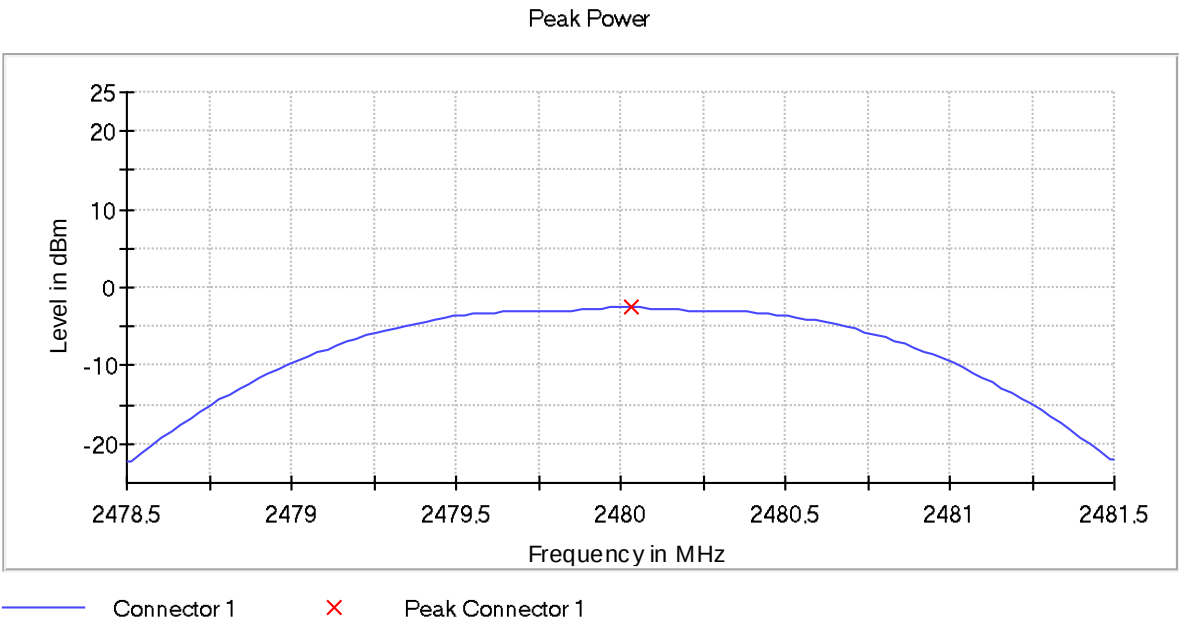
- Low Channel:



- Middle Channel:



- High Channel:



Setting	Instrument Value (Low Channel)	Instrument Value (Middle Channel)	Instrument Value (High Channel)
Start Frequency	2.40050 GHz	2.43850 GHz	2.47850 GHz
Stop Frequency	2.40350 GHz	2.44150 GHz	2.48150 GHz
Span	3.000 MHz	3.000 MHz	3.000 MHz
RBW	1.000 MHz	1.000 MHz	1.000 MHz
VBW	3.000 MHz	3.000 MHz	3.000 MHz
SweepPoints	101	101	101
SweepTime	1.907 µs	1.907 µs	1.907 µs
Reference Level	0.000 dBm	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	20.000 dB	20.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
SweepCount	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Preamp	off	off	off
Stablemode	Trace	Trace	Trace
Run	4 / max. 150	4 / max. 150	5 / max. 150

FCC 15.247 (d) / RSS-247 5.5. Band-Edge Emissions Compliance (Transmitter)

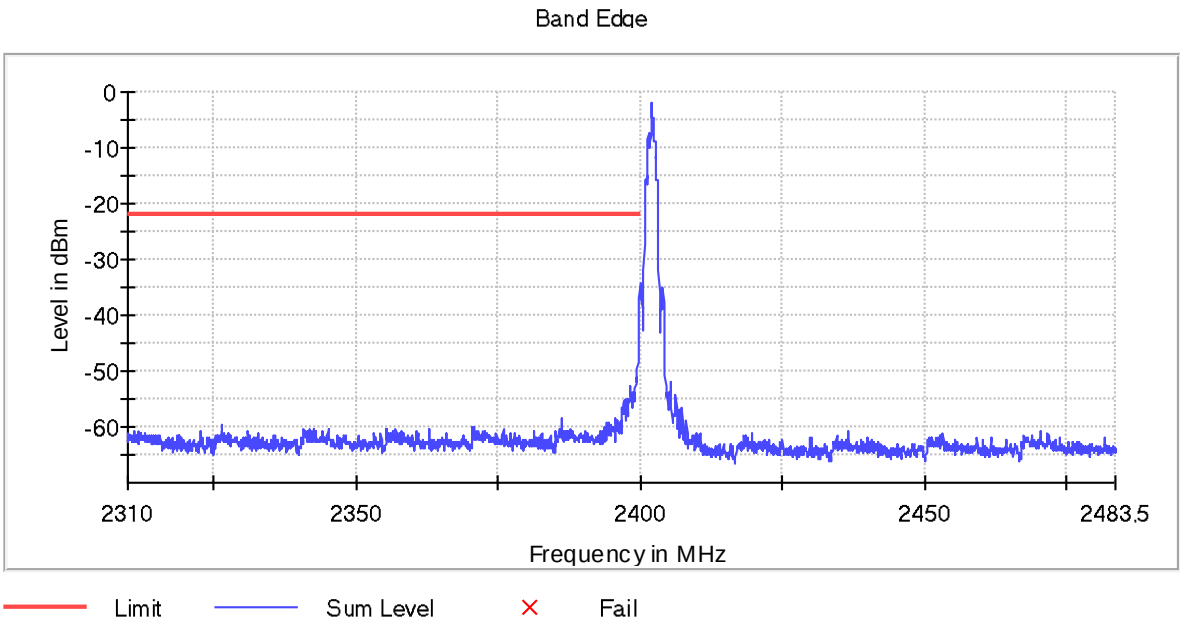
SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

• 2M modulation:

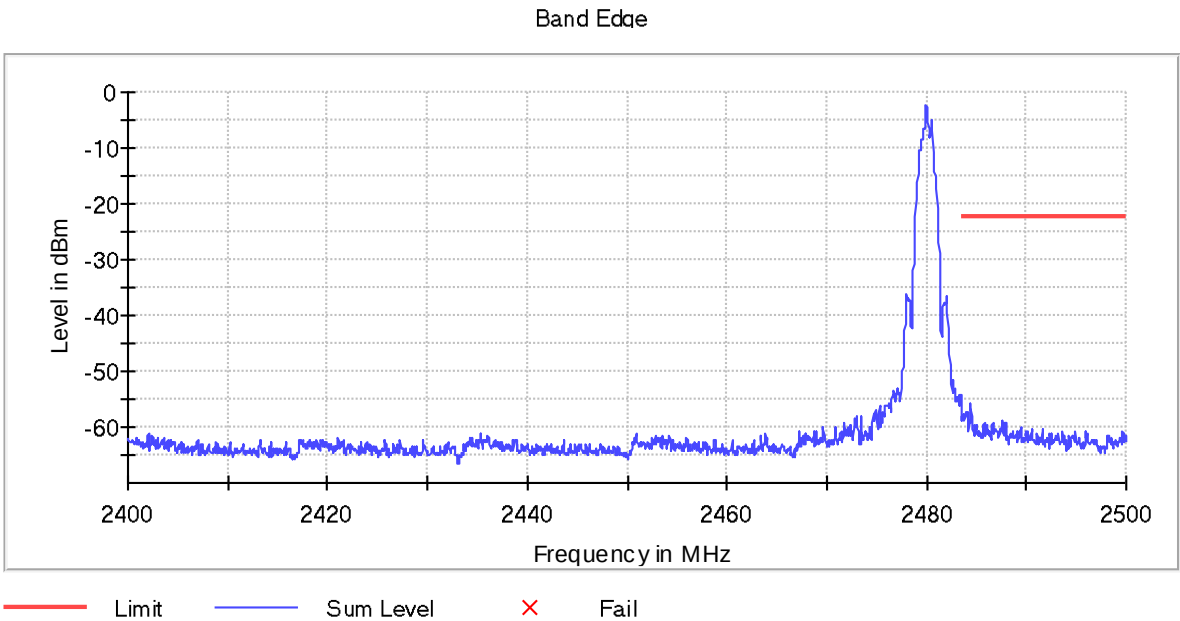
- Low Channel:



Measurement uncertainty (dB)	<±1.53
------------------------------	--------

Setting	Instrument Value (Meas.)	Instrument Value (Meas.2)
Start Frequency	2.31000 GHz	2.40000 GHz
Stop Frequency	2.40000 GHz	2.48350 GHz
Span	90.000 MHz	83.500 MHz
RBW	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz
SweepPoints	1800	1670
SweepTime	113.672 µs	94.727 µs
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	20.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Preamp	off	off
Stablemode	Trace	Trace
Run	11 / max. 150	16 / max. 150

- High Channel:



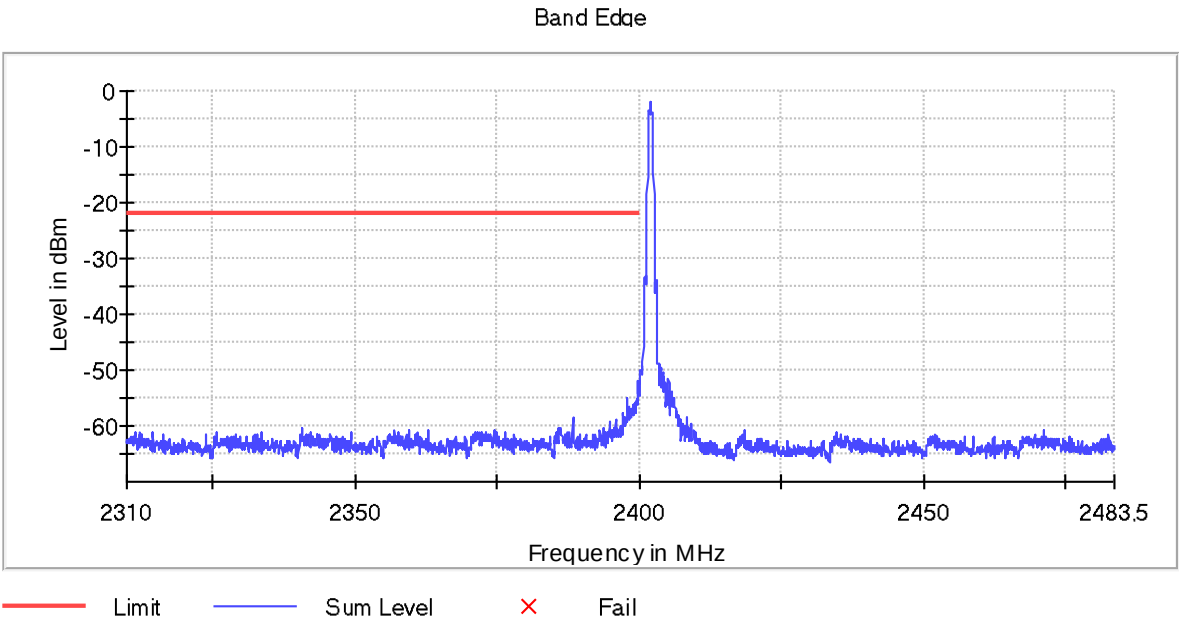
Measurement uncertainty (dB)	<±1.53
------------------------------	--------

Setting	Instrument Value (Meas.)	Instrument Value (Meas.2)
Start Frequency	2.40000 GHz	2.48350 GHz
Stop Frequency	2.48350 GHz	2.50000 GHz
Span	83.500 MHz	16.500 MHz
RBW	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz
SweepPoints	1670	330
Sweptime	94.727 µs	18.945 µs
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	20.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Preamp	off	off
Stablemode	Trace	Trace
Run	22 / max. 150	4 / max. 150

Verdict: PASS

• 1M modulation:

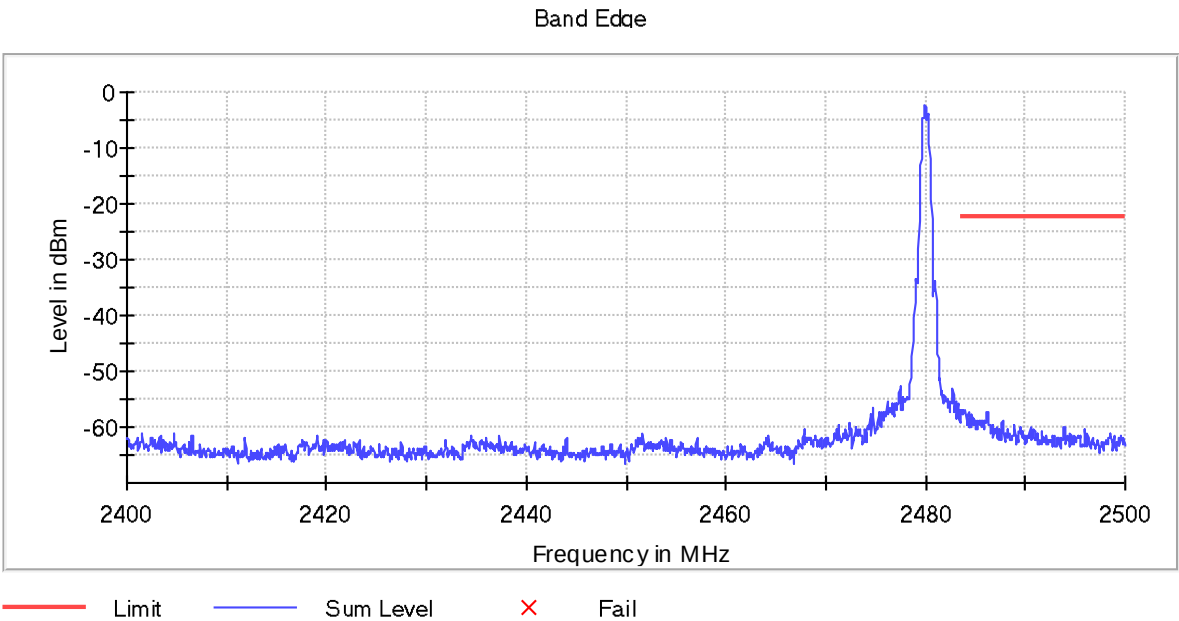
- Low Channel:



Measurement uncertainty (dB)	<±1.53
------------------------------	--------

Setting	Instrument Value (Meas.)	Instrument Value (Meas.2)
Start Frequency	2.31000 GHz	2.40000 GHz
Stop Frequency	2.40000 GHz	2.48350 GHz
Span	90.000 MHz	83.500 MHz
RBW	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz
SweepPoints	1800	1670
Sweeptime	113.672 µs	94.727 µs
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	20.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Preamp	off	off
Stablemode	Trace	Trace
Run	4 / max. 150	15 / max. 150

- High Channel:



Measurement uncertainty (dB)	<±1.53
------------------------------	--------

Setting	Instrument Value (Meas.)	Instrument Value (Meas.2)
Start Frequency	2.40000 GHz	2.48350 GHz
Stop Frequency	2.48350 GHz	2.50000 GHz
Span	83.500 MHz	16.500 MHz
RBW	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz
SweepPoints	1670	330
Sweptime	94.727 µs	18.945 µs
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	20.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Preamp	off	off
Stablemode	Trace	Trace
Run	10 / max. 150	4 / max. 150

Verdict: PASS

FCC 15.247 (e) / RSS-247 5.2. (b) Power Spectral Density

SPECIFICATION:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS:

The maximum power spectral density level in the fundamental emission was measured using the method according to point 11.10.2." Method PKPSD (peak PSD)" of ANSI C.63.10-2013.

- **2M modulation:**

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Power Spectral Density (dBm)	-10.82	-11.18	-11.22
Measurement uncertainty (dB)	<±0.99		

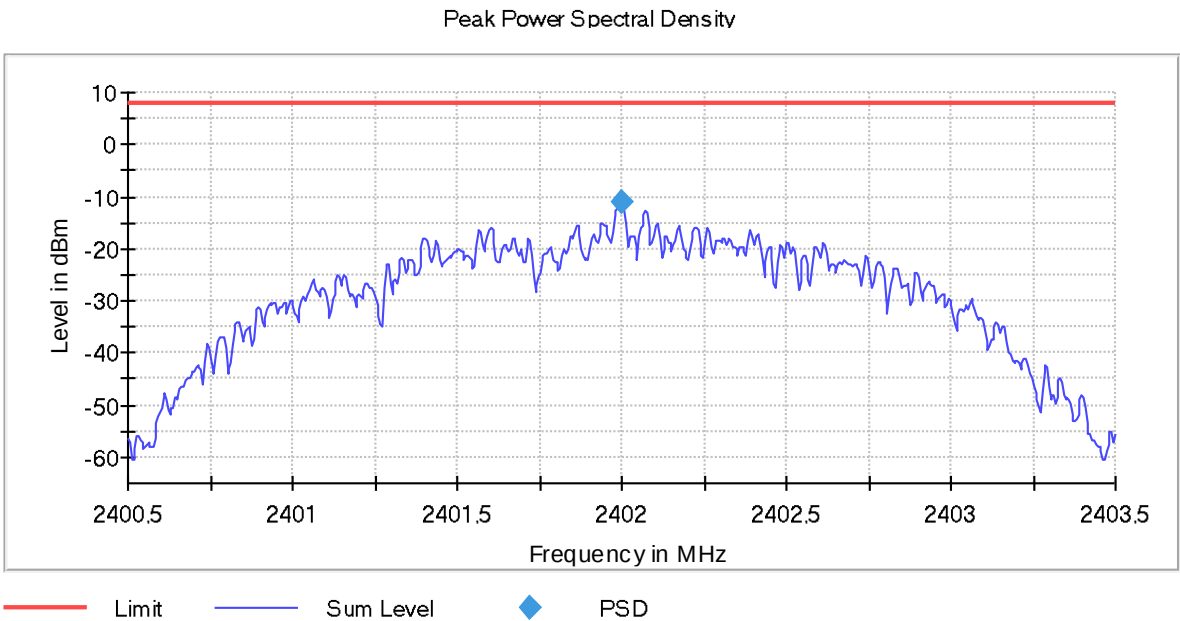
- **1M modulation:**

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Power Spectral Density (dBm)	-11.04	-11.15	-10.21
Measurement uncertainty (dB)	<±0.99		

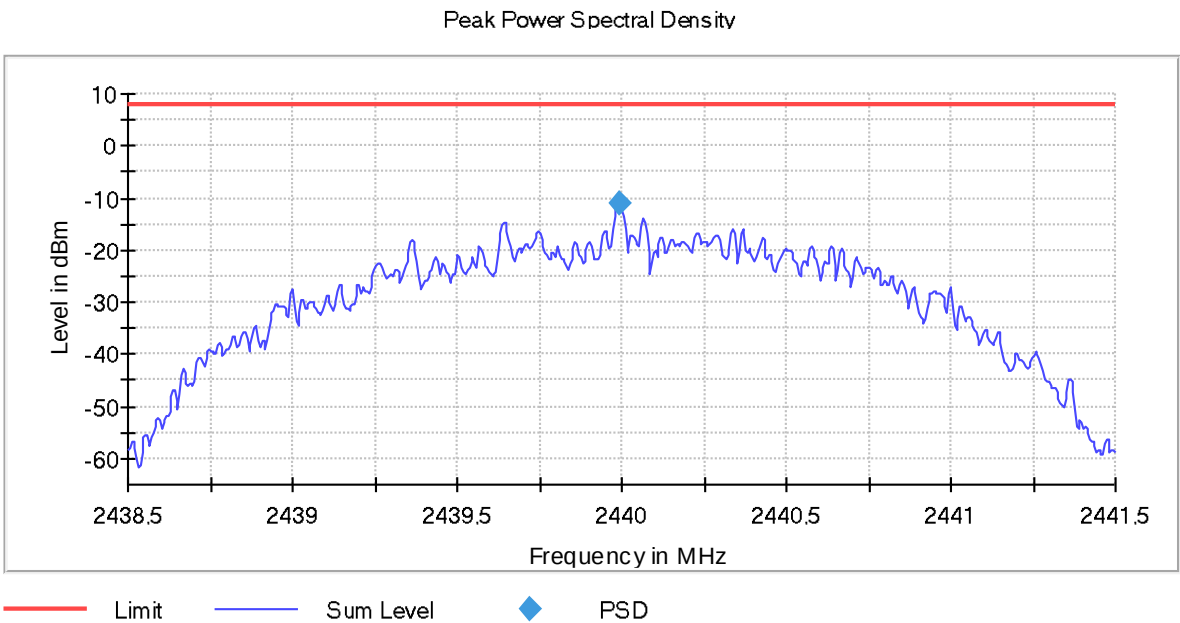
Verdict: PASS

2M modulation:

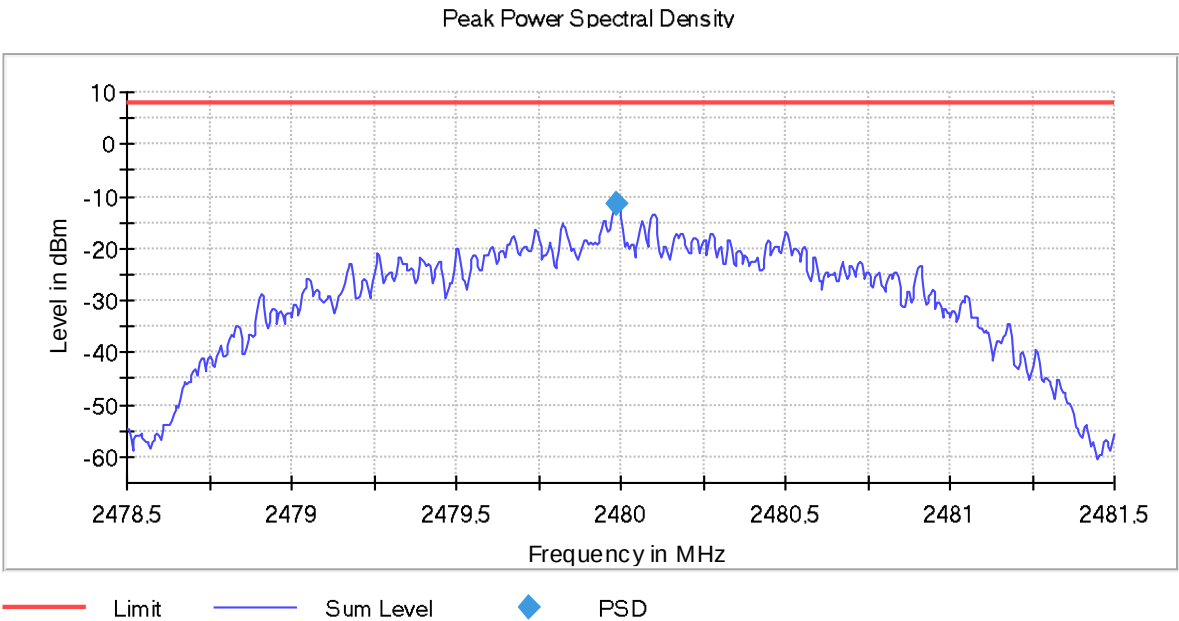
- Low Channel:



- Middle Channel:



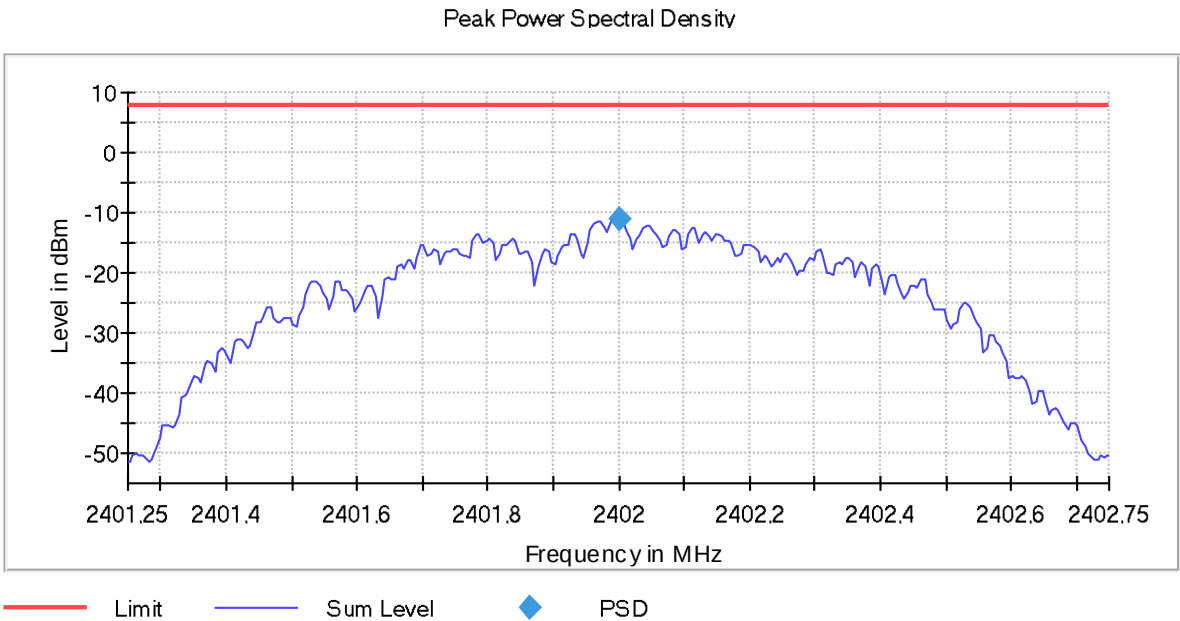
- High Channel:



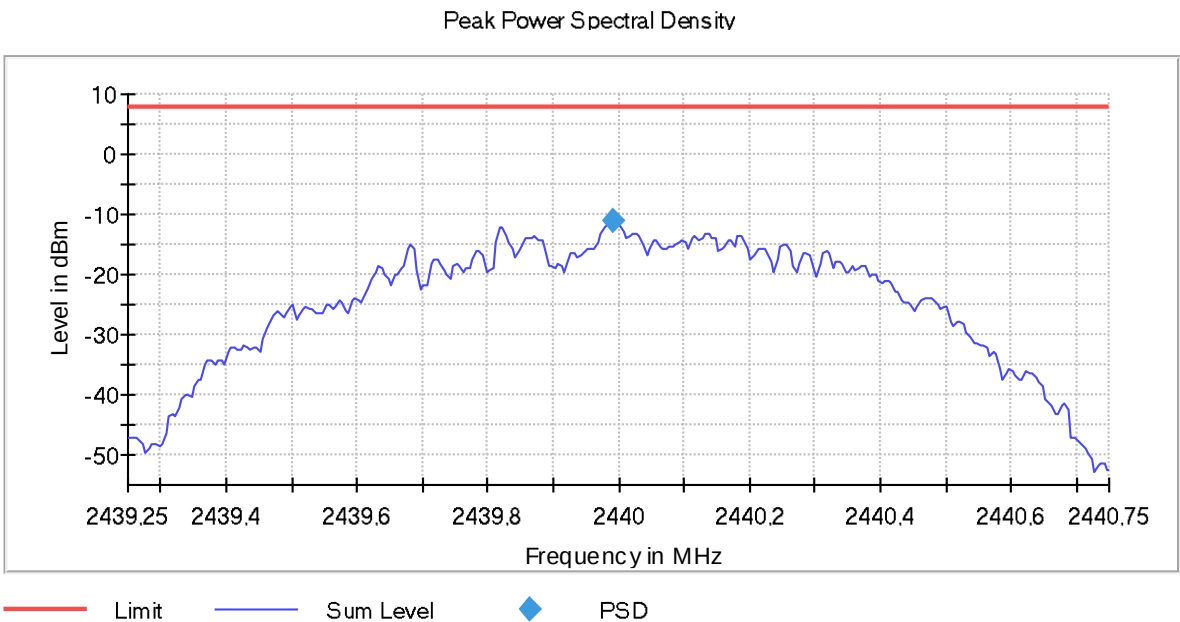
Setting	Instrument Value (Low Channel)	Instrument Value (Middle Channel)	Instrument Value (High Channel)
Start Frequency	2.40050 GHz	2.43850 GHz	2.47850 GHz
Stop Frequency	2.40350 GHz	2.44150 GHz	2.48150 GHz
Span	3.000 MHz	3.000 MHz	3.000 MHz
RBW	10.000 kHz	10.000 kHz	10.000 kHz
VBW	30.000 kHz	30.000 kHz	30.000 kHz
SweepPoints	600	600	600
SweepTime	3.000 ms	3.000 ms	3.000 ms
Reference Level	-10.000 dBm	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	10.000 dB	10.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
SweepCount	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Preamplifier	off	off	off
Stablemode	Trace	Trace	Trace
Run	17 / max. 150	14 / max. 150	13 / max. 150

1M modulation:

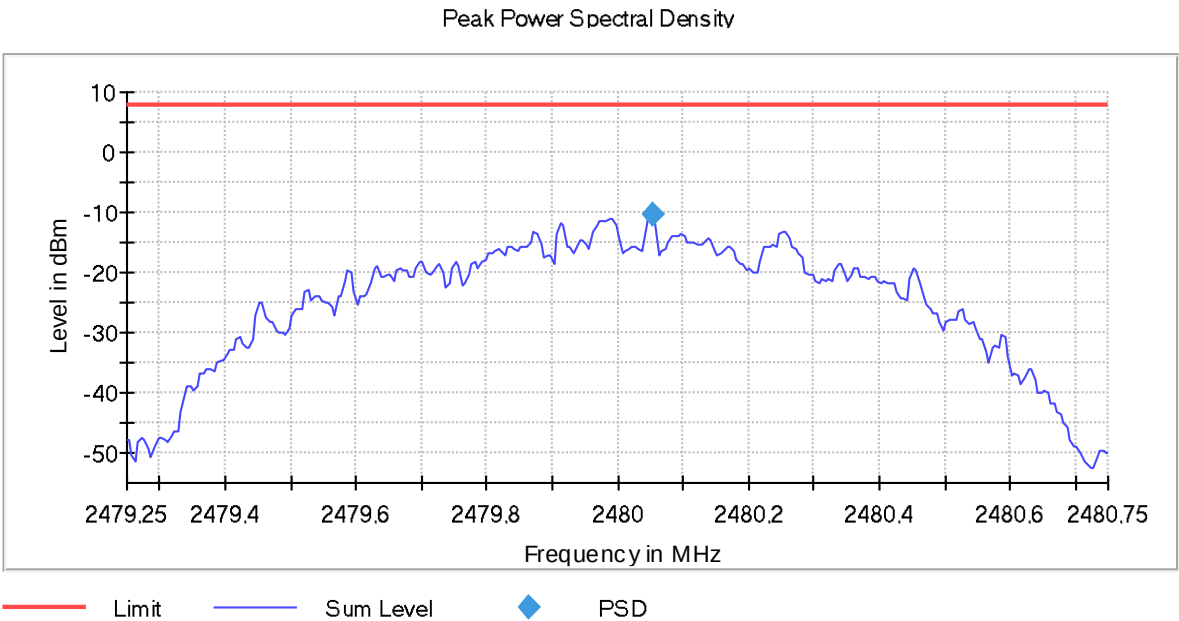
- Low Channel:



- Middle Channel:



- High Channel:



Setting	Instrument Value (Low Channel)	Instrument Value (Middle Channel)	Instrument Value (High Channel)
Start Frequency	2.40125 GHz	2.43925 GHz	2.47925 GHz
Stop Frequency	2.40275 GHz	2.44075 GHz	2.48075 GHz
Span	1.500 MHz	1.500 MHz	1.500 MHz
RBW	10.000 kHz	10.000 kHz	10.000 kHz
VBW	30.000 kHz	30.000 kHz	30.000 kHz
SweepPoints	300	300	300
SweepTime	1.500 ms	1.500 ms	1.500 ms
Reference Level	-10.000 dBm	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	10.000 dB	10.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
SweepCount	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Preamp	off	off	off
Stablemode	Trace	Trace	Trace
Run	14 / max. 150	12 / max. 150	6 / max. 150

FCC 15.247 (d) / RSS-247 5.5. Emission Limitations Radiated (Transmitter)

SPECIFICATION:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)/RSS-Gen):

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 10000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247: Attenuation below the general field strength limits specified in RSS-Gen is not required.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-17 GHz and at distance of 1 m for the frequency range 17 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Frequency range 30 MHz - 1 GHz:

The spurious frequencies detected do not depend neither on the operating channel nor the modulation mode.

No spurious frequencies detected at less than 20 dB below the limit.

Measurement Uncertainty (dB) $< \pm 5.01$

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious frequencies with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

- 2M modulation:**

- LOW CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
4.8102	40.21	H	Peak

- MIDDLE CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
4.8812	43.45	H	Peak
9.7702	50.25	H	Peak

- HIGH CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
4.9627	42.27	H	Peak

Measurement Uncertainty: 1-3 GHz <±4.11 dB
 3-17 GHz <±4.32 dB
 17-26 GHz <±4.58 dB

Verdict: PASS

- **1M modulation:**

- LOW CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
4.8041	40.23	H	Peak
9.6088	51.53	H	Peak

- MIDDLE CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
4.8799	43.98	H	Peak
9.7600	50.46	H	Peak

- HIGH CHANNEL. Spurious frequencies detected closest to the limit:

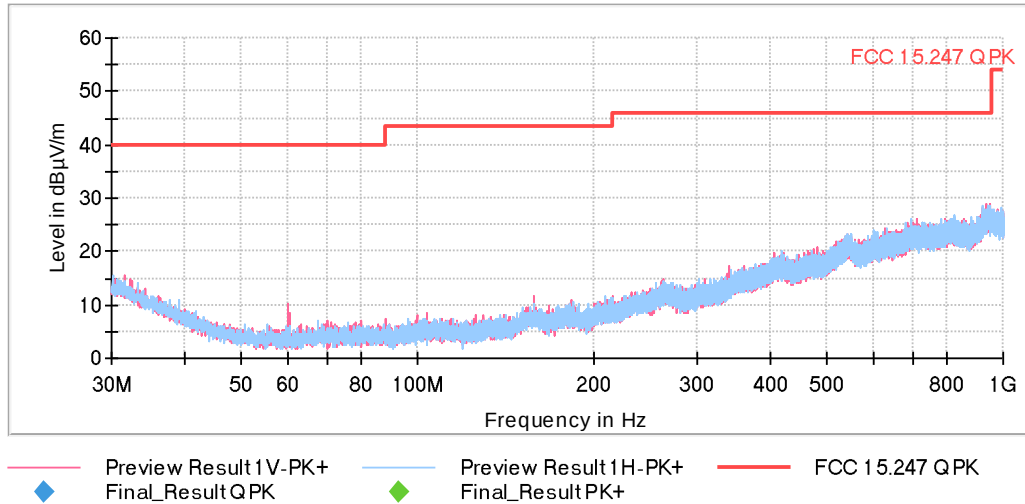
Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
4.9598	42.33	H	Peak

Measurement Uncertainty: 1-3 GHz < $\pm$ 4.11 dB
 3-17 GHz < $\pm$ 4.32 dB
 17-26 GHz < $\pm$ 4.58 dB

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

The spurious frequencies detected do not depend neither on the operating channel nor the modulation mode.

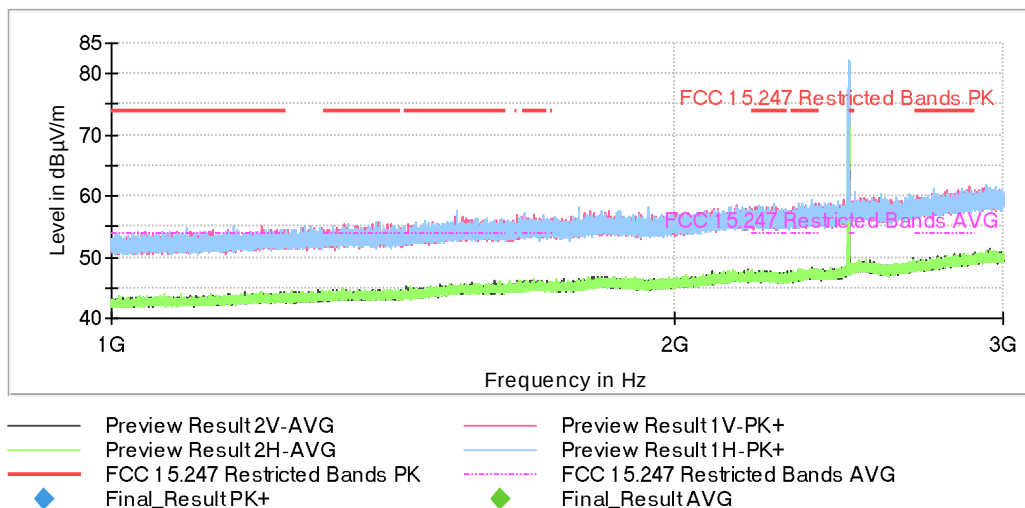


This plot is valid for the Low, Middle and High Channels.

• 2M modulation:

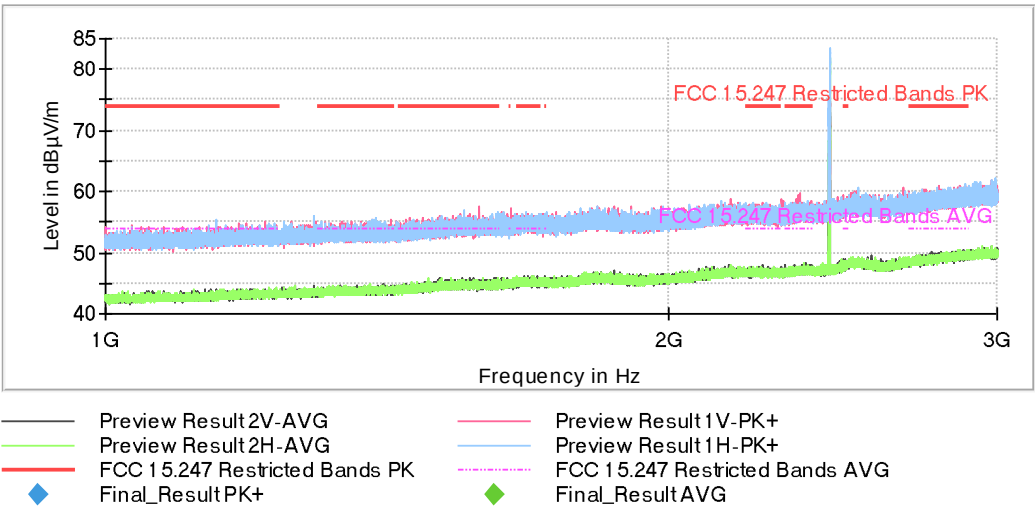
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



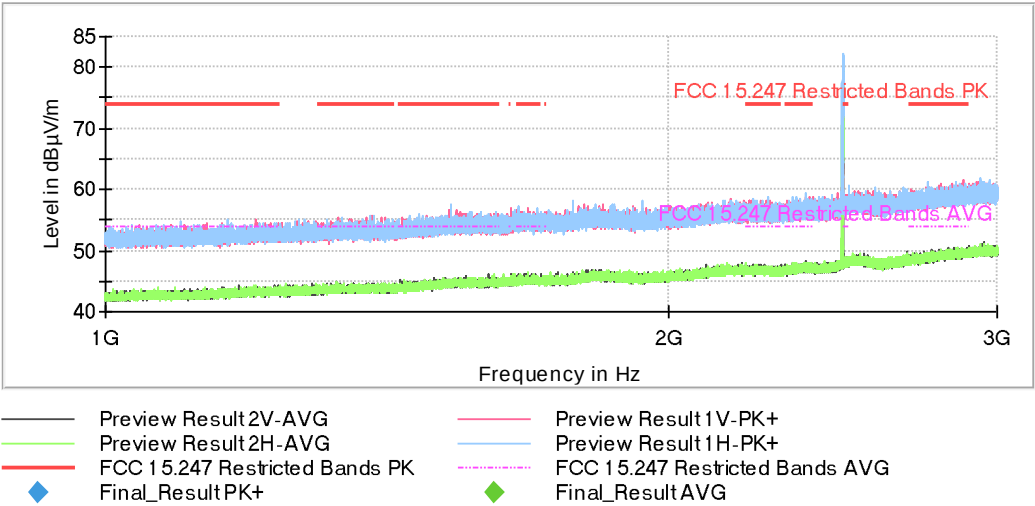
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

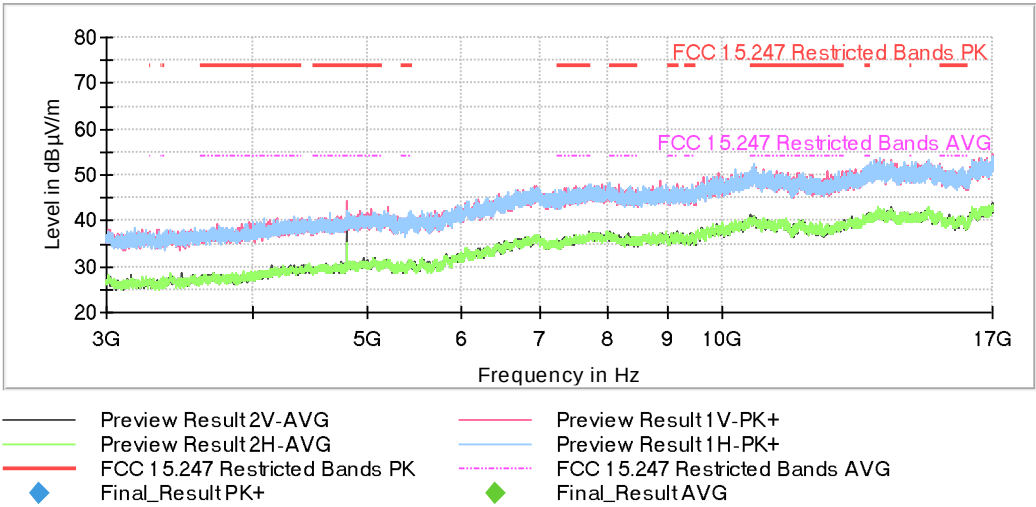
- High Channel:



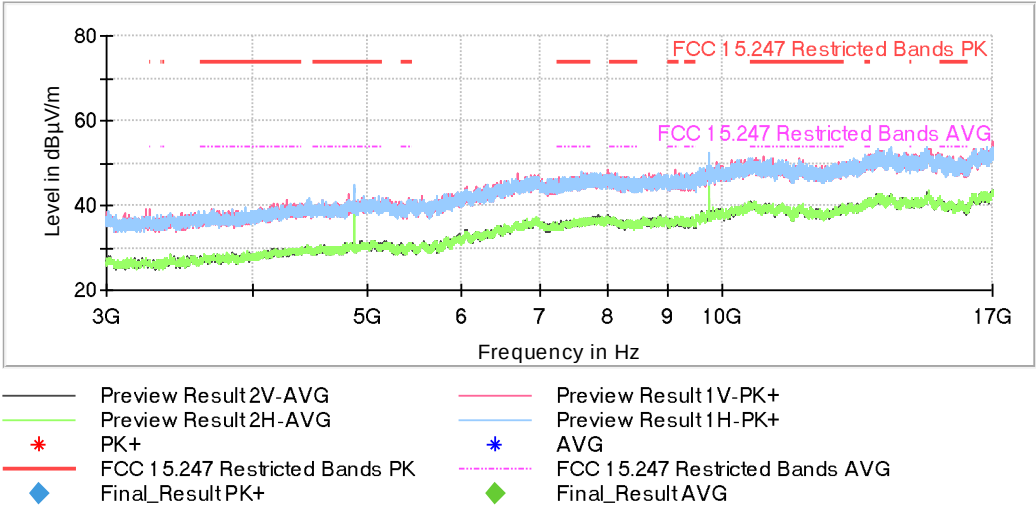
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

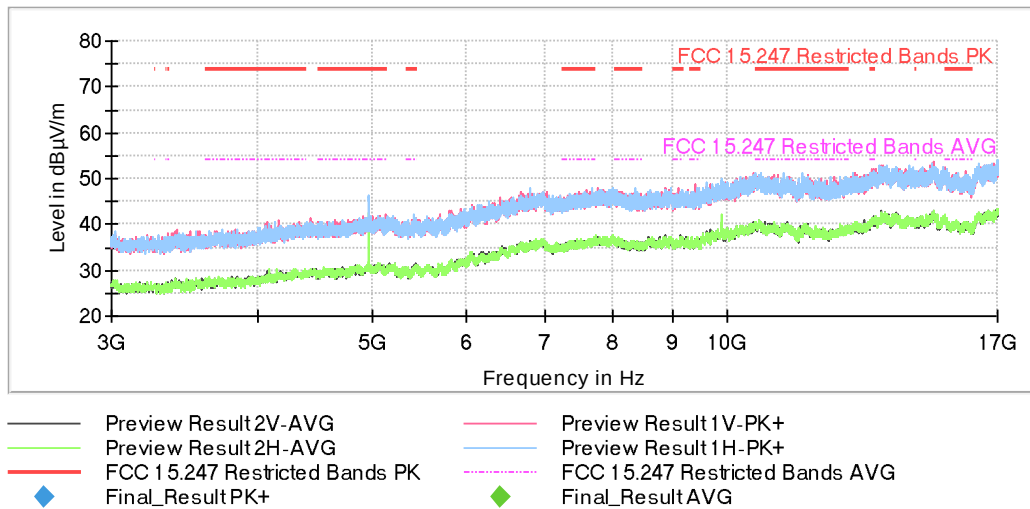
- Low Channel:



- Middle Channel:

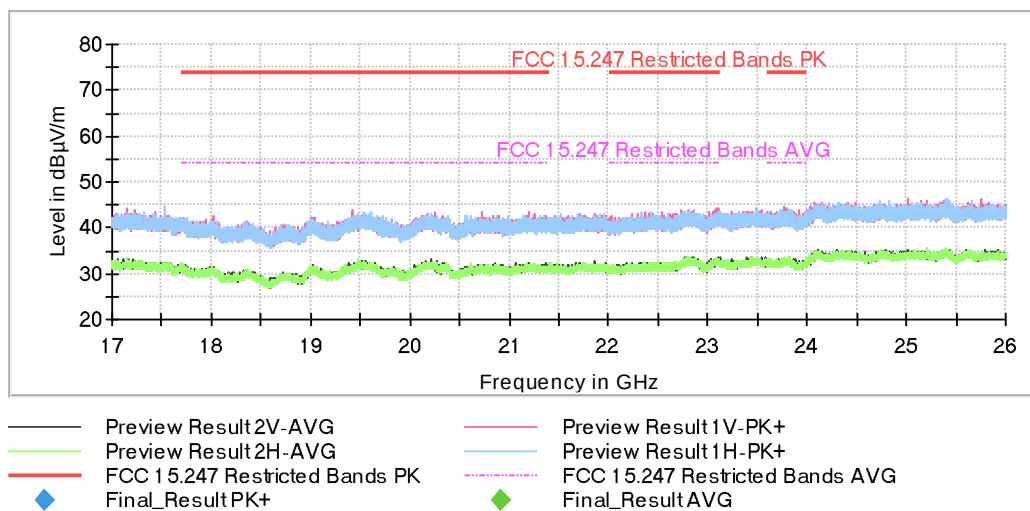


- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

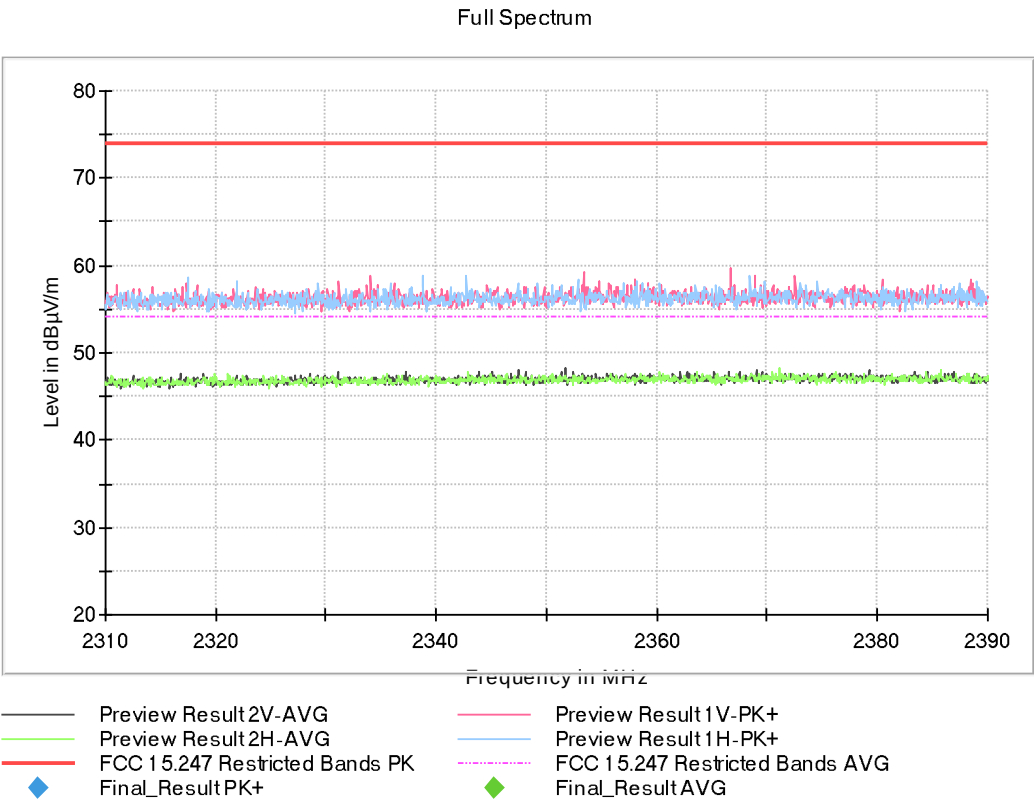
The spurious frequencies detected do not depend on the operating channel.



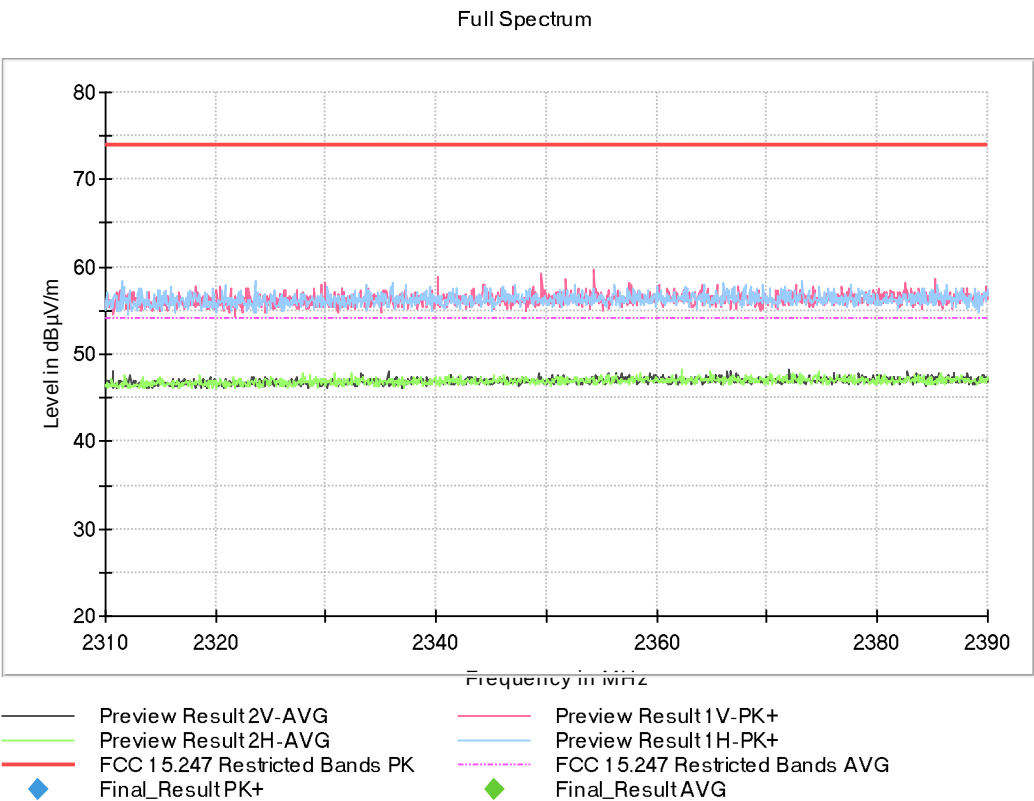
This plot is valid for the Low, Middle and High Channels.

FREQUENCY RANGE 2.31-2.39 GHz:

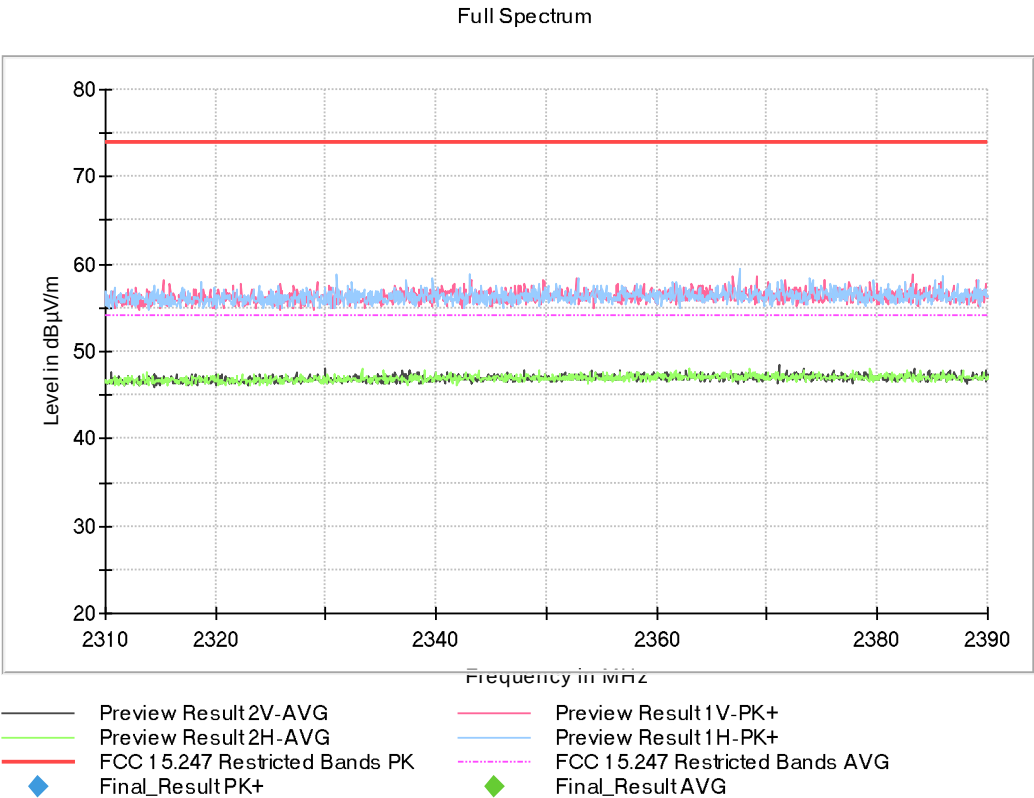
- Low Channel:



- Middle Channel:

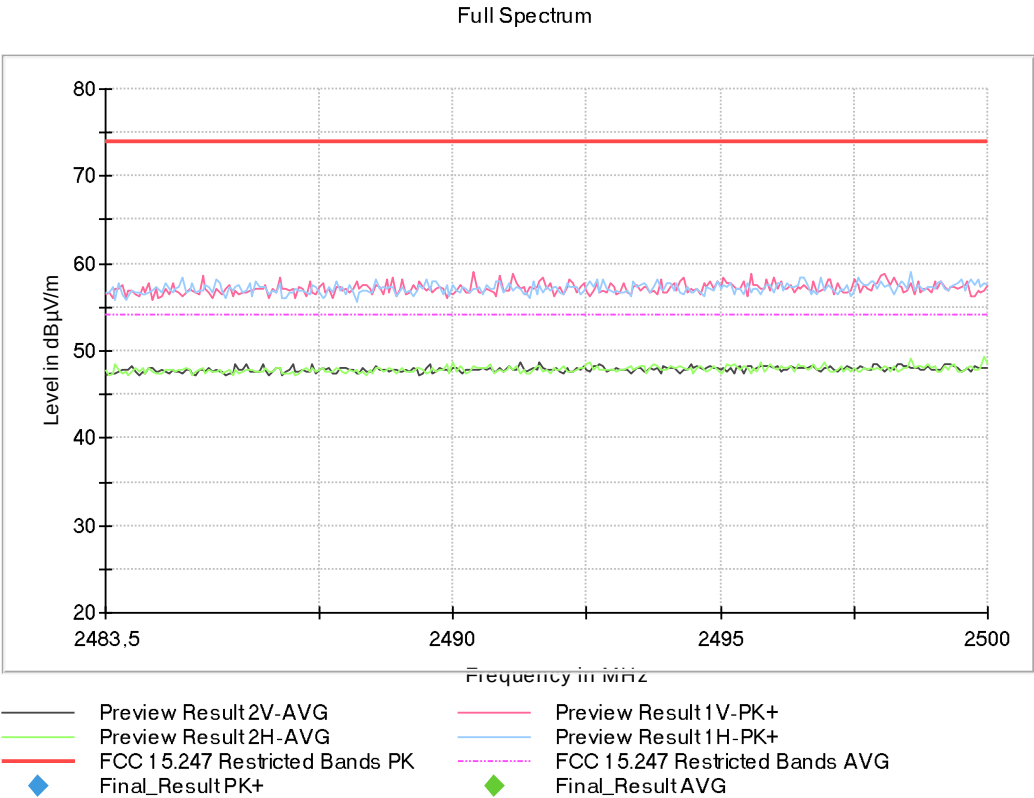


- High Channel:



FREQUENCY RANGE 2.4835-2.5 GHz:

- Low Channel:



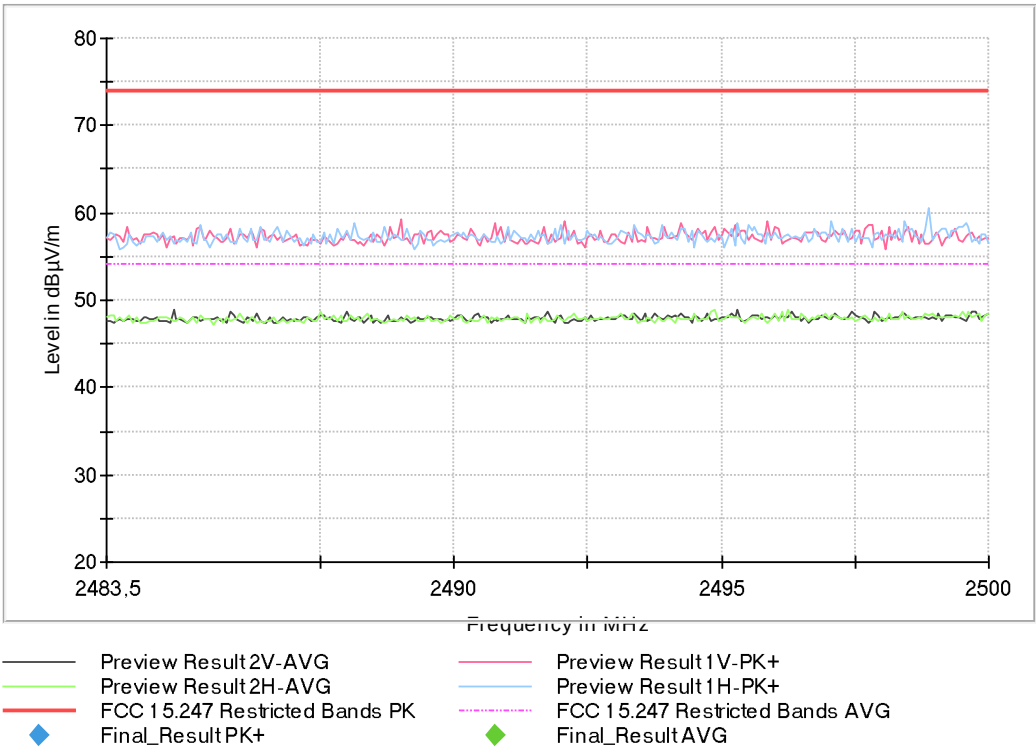
- Middle Channel:

Full Spectrum



- High Channel:

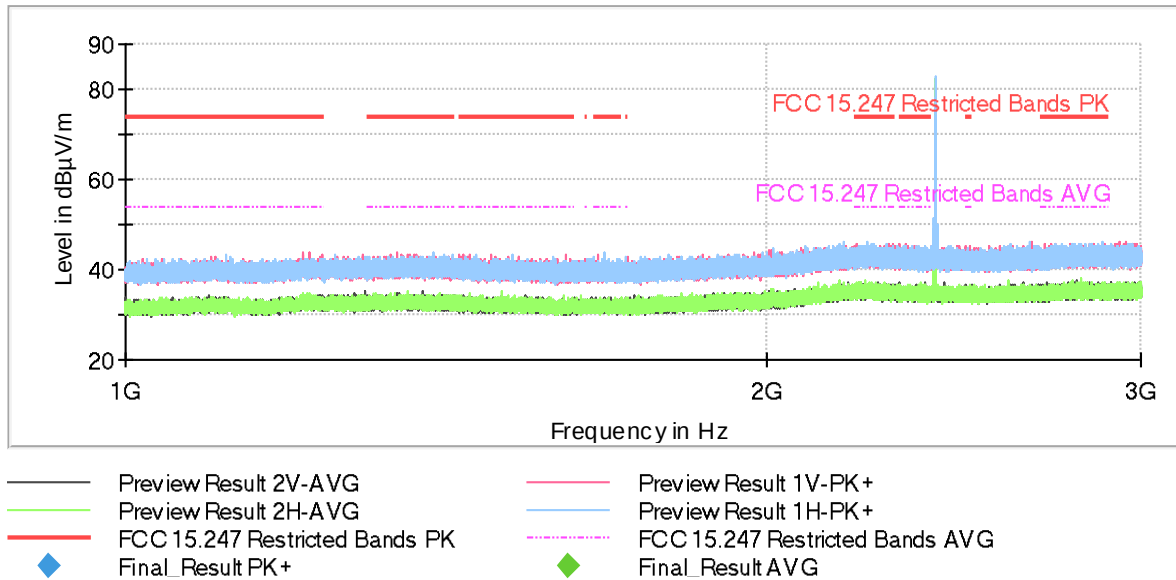
Full Spectrum



- **1M modulation:**

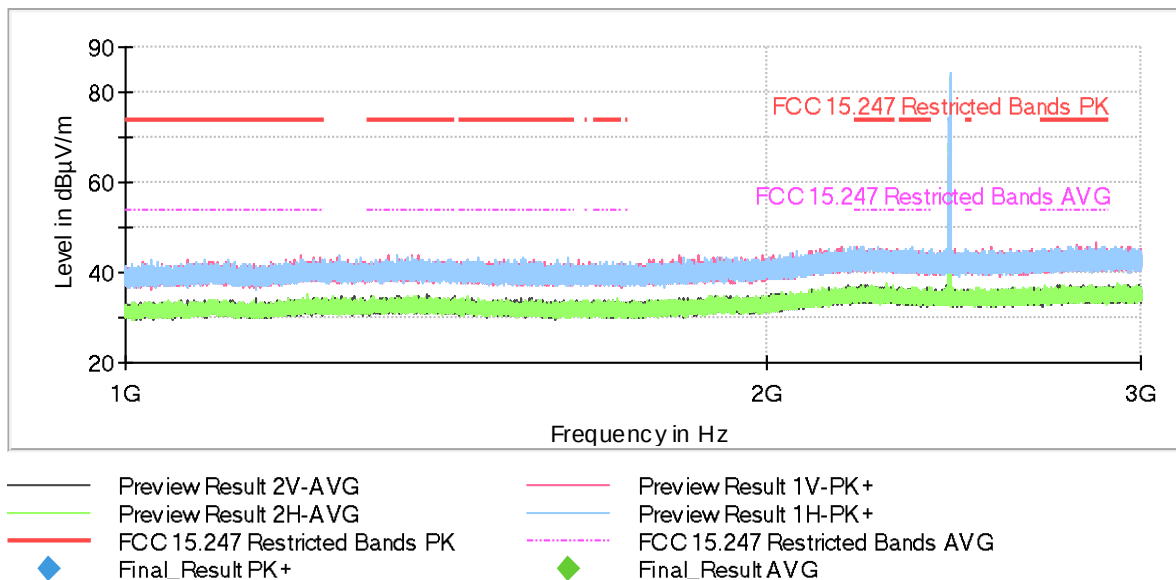
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



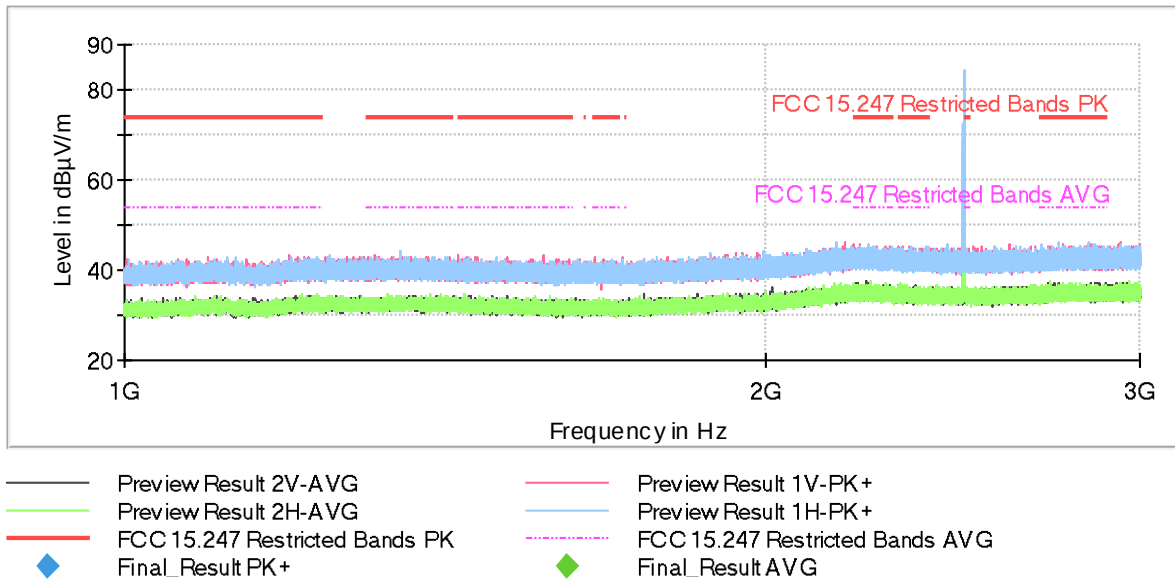
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

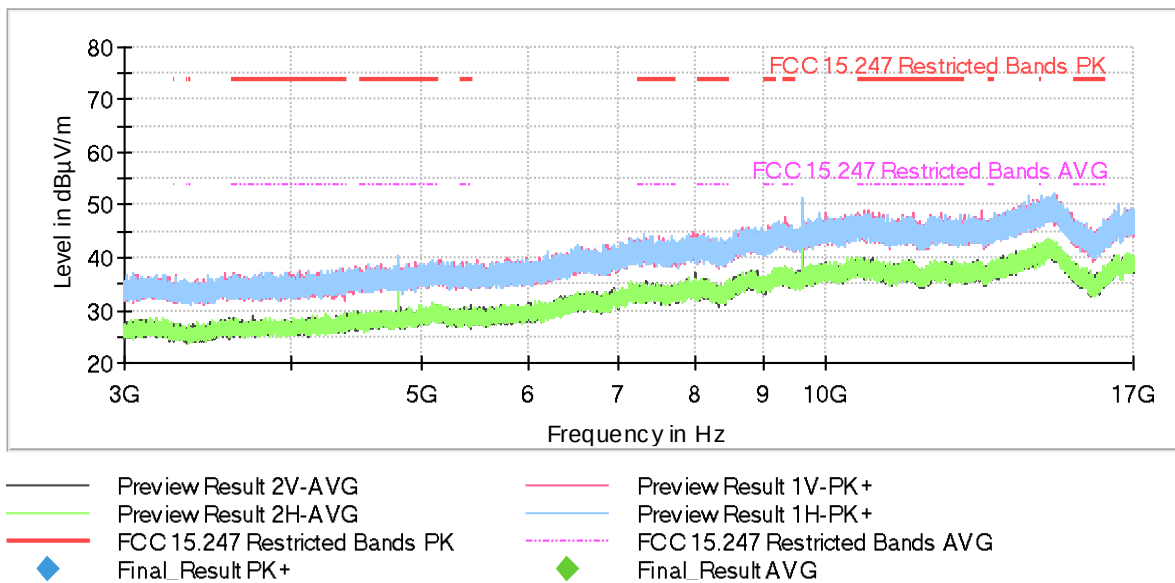
- High Channel:



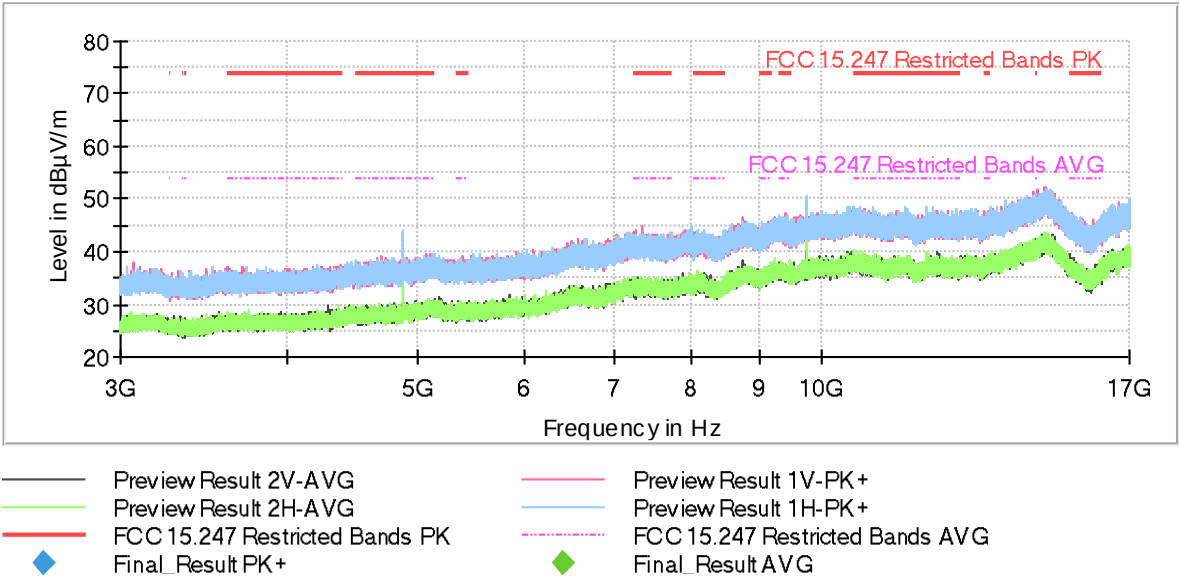
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

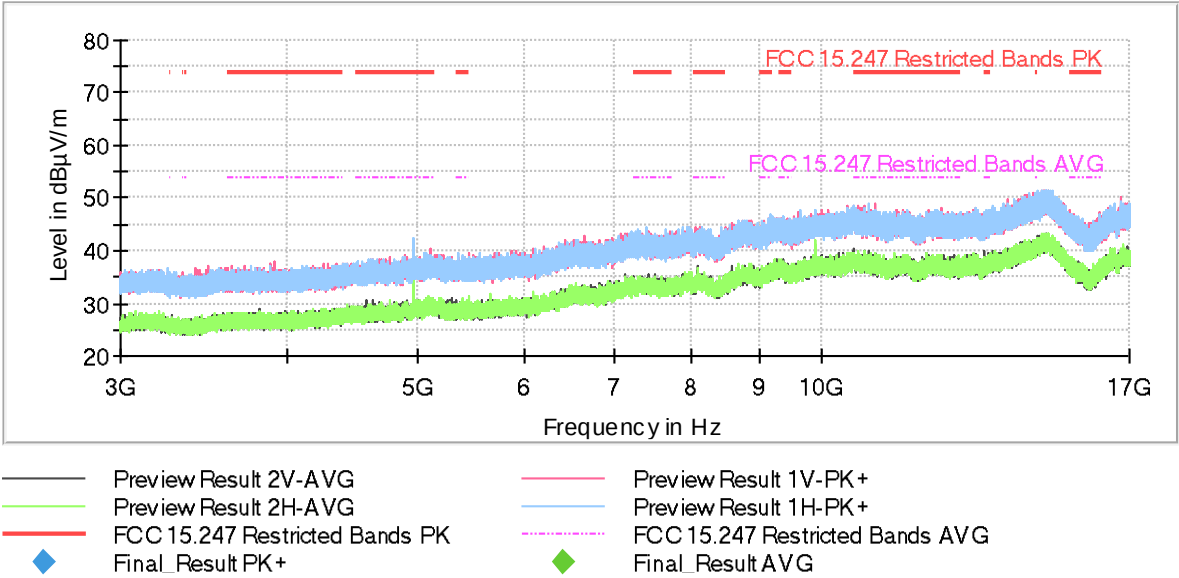
- Low Channel:



- Middle Channel:

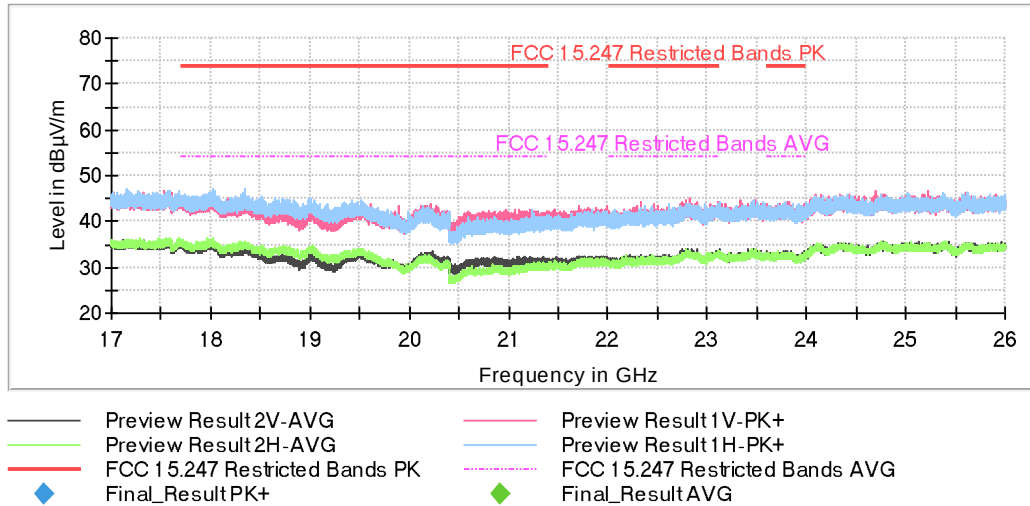


- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

The spurious frequencies detected do not depend on the operating channel.

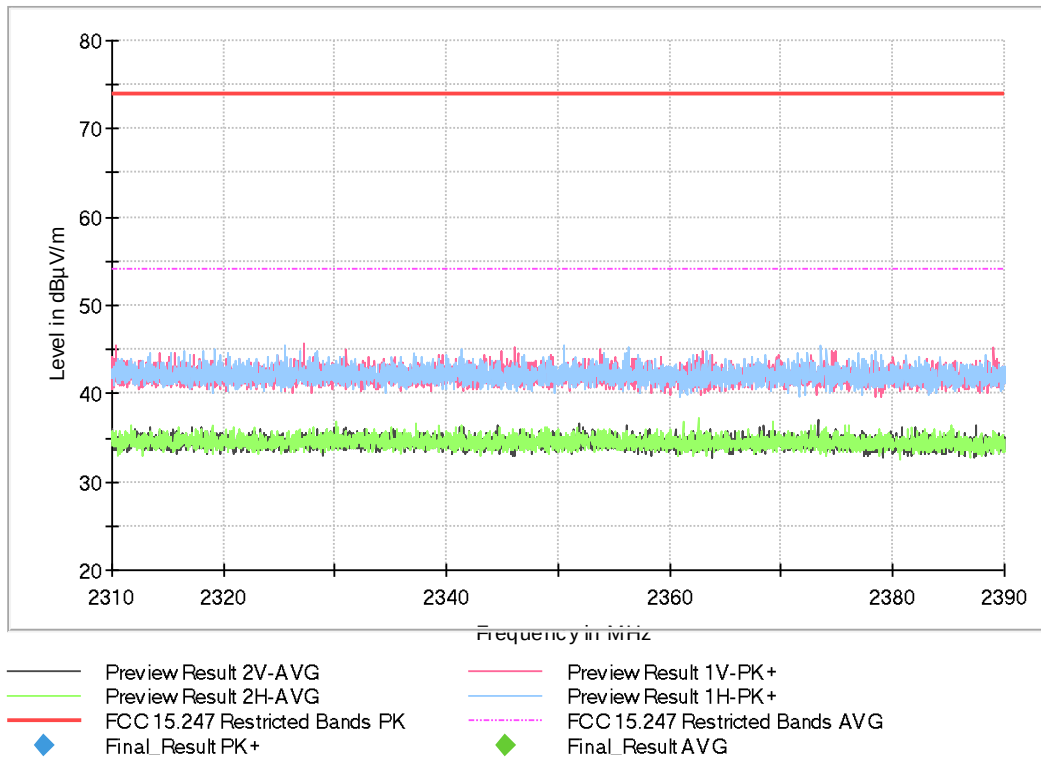


This plot is valid for the Low, Middle and High Channels.

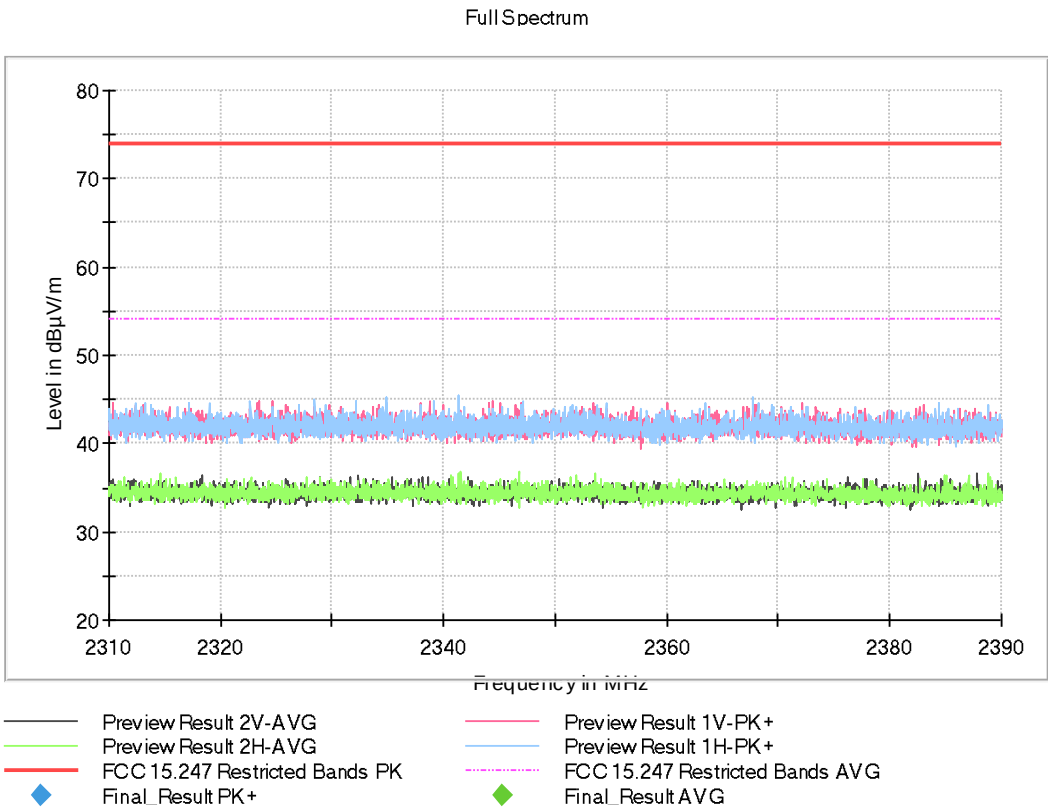
FREQUENCY RANGE 2.31-2.39 GHz:

- Low Channel:

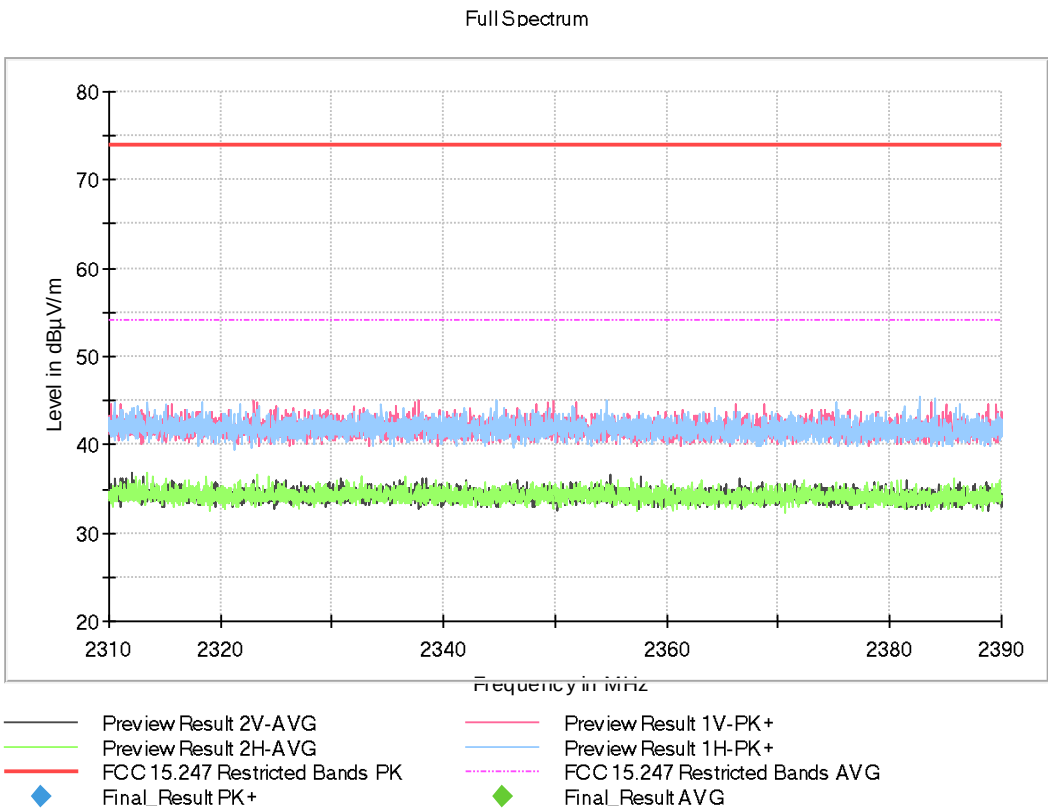
Full Spectrum



- Middle Channel:

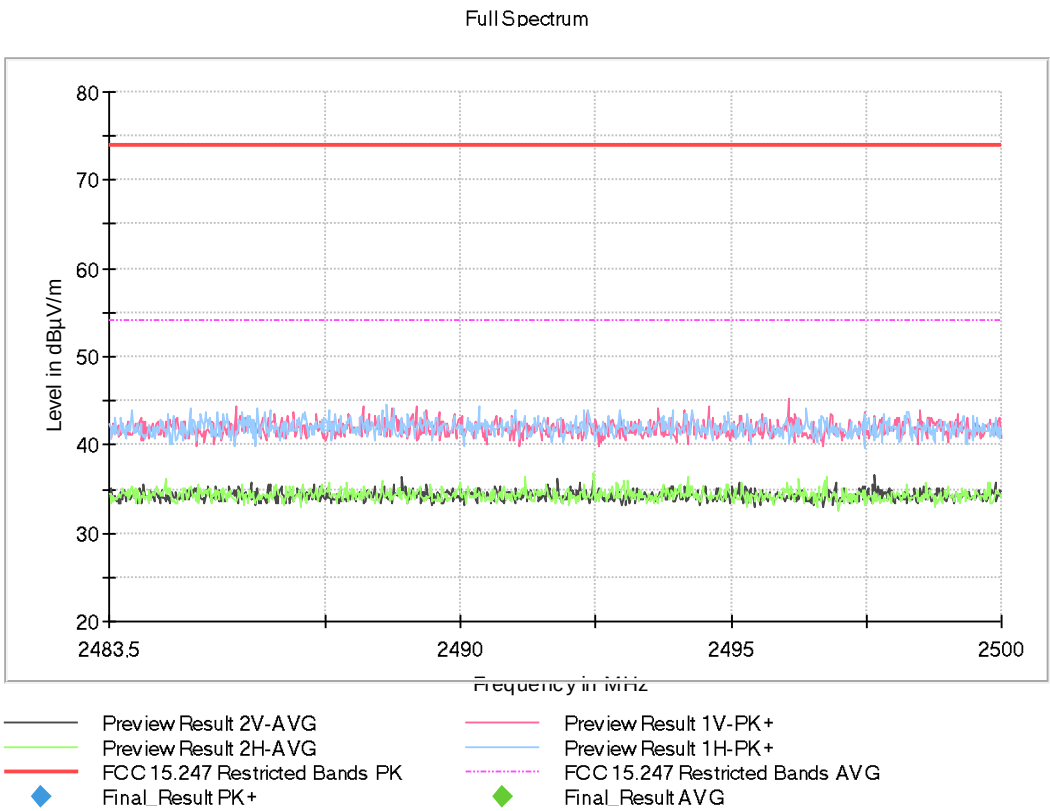


- High Channel:

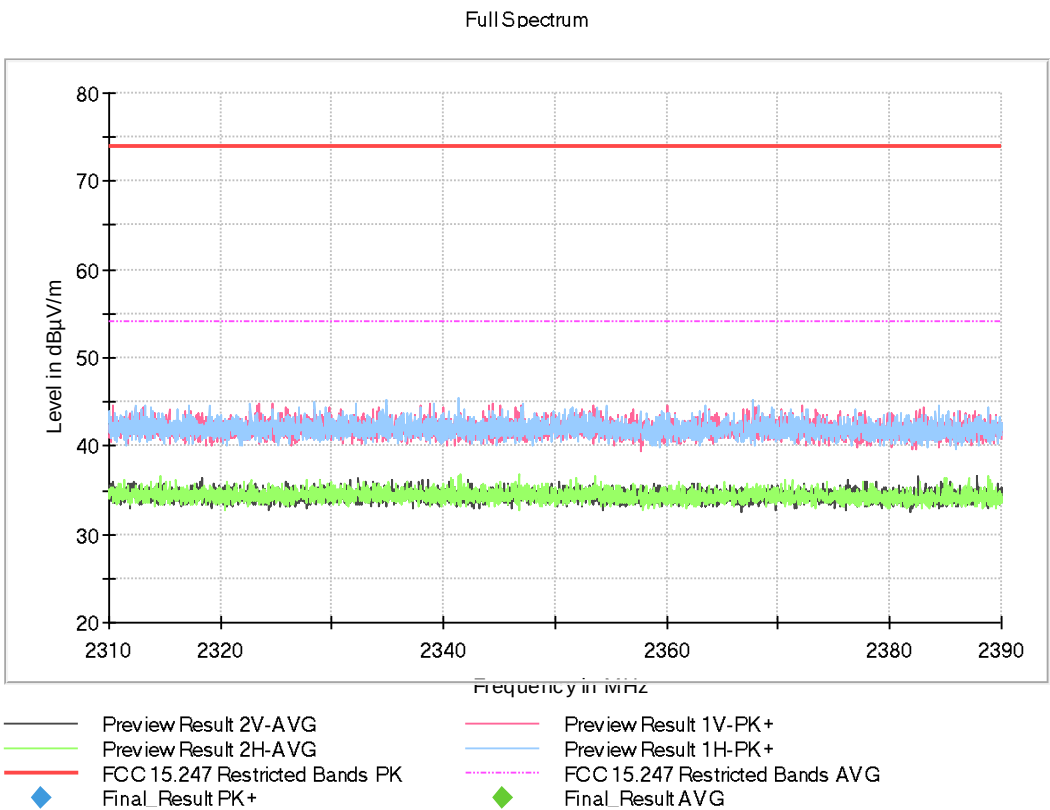


FREQUENCY RANGE 2.4835-2.5 GHz:

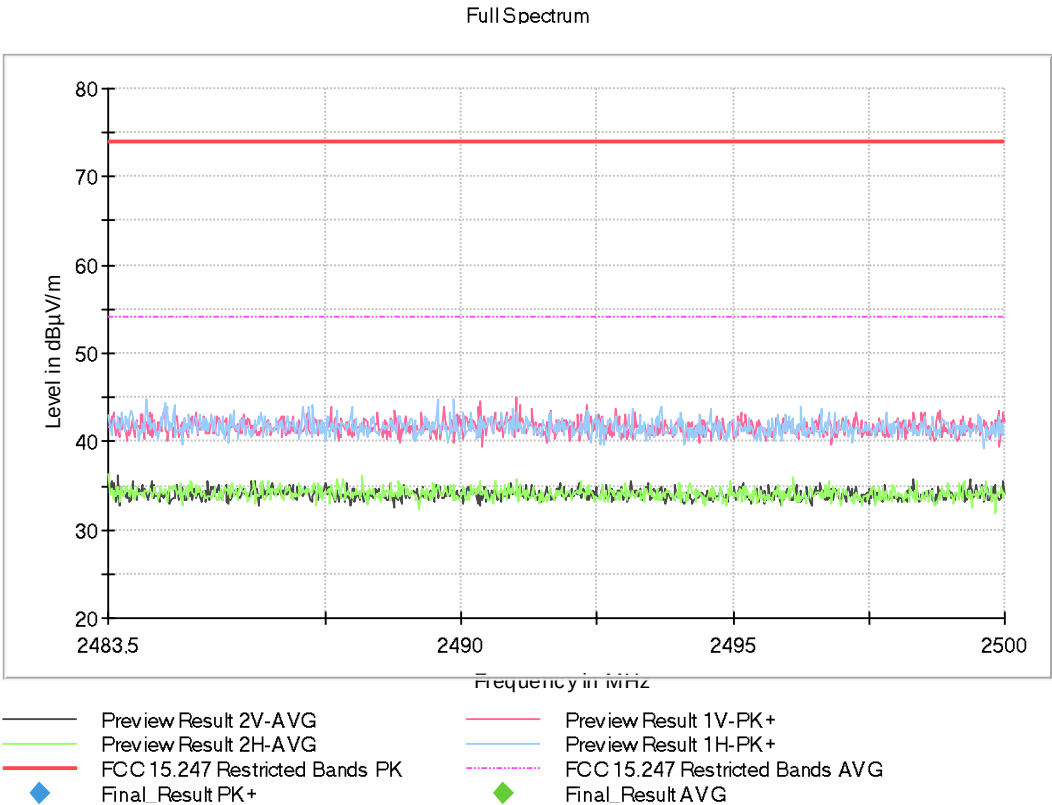
- Low Channel:



- Middle Channel:



- High Channel:



Spectrum analyzer settings:

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESR 7] 30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB
Receiver: [FSW 50] 1 GHz - 3 GHz	20 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
Receiver: [FSW 50] 3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
Receiver: [FSV 40] 17 GHz - 26 GHz	281,25 kHz	PK+ ; AVG	1 MHz	1 s	0 dB